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ABSTRACT

Presented are the stories of 12 notable black scientists and inventors. Each individual was selected for scientific and inventive excellence with the added accounts of their excellence as citizens, family men, and humanitarians. (Author/RE)

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INTRODUCTION

BLACK men have served America well through their scientific and technological gifts to the nation's treasure of knowledge and capability. Moreover, they have done so over the years from as far back as colonial days. Their contributions while admirable in themselves have been all the more remarkable because what they did was often accomplished in the face of discouraging social and political barriers created because of their race. Still, these men were able to summon up some unusual inner resources that enabled them to make exceptional use of their considerable mental talents and imagination. They discovered, created, and invented in the arenas of communications, transportation, industry, agriculture, health, housing, and clothing. Mankind has been benefited by their contributions. Yet despite their accomplishments, black American scientists and inventors remain largely anonymous.

This book gives the stories of twelve fascinating scientists and inventors of color. Each of them seemed to possess some intuitive ability to ask the right questions about the nature of things and of man and then set out on a determined path to find answers. While these twelve were selected for their scientific and inventive excellence, one notes with interest that they were also family men, good citizens, and often concerned about the welfare of their fellowman.

No attempt has been made to present the complete saga of black American scientists, nor to treat in detail the technical aspects of their special fields. Rather, the intent has been to enlighten, inspire, and speak to the social need of establishing, maintaining, and improving the "good" human environment that encourages discovery and the full development and utilization of the talents to which this country has given birth. With the possibility of a world famine a frightening threat, and dwindling and irreplaceable hydrocarbon sources of energy a stark possibility, our needs demand no less.

Edward S. Jenkins

ERNEST E. JUST



Cell Physiologist 1883-1941

Edward S. Jenkins

THE tall, slender black teenager watched the docks grow smaller as the ship steamed out into the Atlantic. He could hardly be blamed for feeling a mixture of excitement and apprehension as he moved farther from his native Charleston, South Carolina. Ernest Everett Just had been born in that city seventeen years earlier on a hot August 14, 1883. He had almost no chance to ever know his father because the elder Just, a dock worker, had died when Ernest was only four years old. With the principal breadwinner gone, Ernest had begun to work at a tender age, laboring long, sweaty hours in the fields to help his mother support the family. Though he could not have known it at the time, even as he cultivated the grounds and harvested the crops, he was laying a foundation for a far different life.

But as hard and as willingly as he worked in the fields to help the family, Ernest applied himself even more enthusiastically to his studies.

His keen mind absorbed quickly what was taught him at school, and he seemed to possess an unending curiosity for more knowledge. His mother, a school teacher, recognized her son's academic talents and knew that he had to have a chance for a college education. So, when at seventeen the lad completed high school in Charleston, Ernest and his mother decided he should go north for further schooling.

Considering the times, this was a courageous and farsighted decision. For then a high school education was looked upon as a fine accomplishment for a black youth. Besides, there were no scholarships and little, if any, encouragement to go off to college. To make matters worse, Ernest did not even have train fare to leave Charleston.

But Ernest had spent all his life in Charleston. He knew that ships were coming to and going from the docks—docks his father had helped build. He decided to hire himself out to one of them, earn fare to New York, and there earn enough money to enroll in college. Thus, the mixture of excitement and apprehension—excitement because he believed that what he was doing was going to lead to new experiences, new knowledge; apprehension because he was leaving the only life he had known—family, friends, the wharves, the soil—and heading into a new life, to a certain degree into the unknown.

At Kimball Academy

Young Ernest Just arrived in New York with \$5 in his pocket. Seeking information on college enrollment, he learned that his educational background was simply too impoverished for him to meet entrance requirements. He was told about Kimball Union Academy in New Hampshire where he could upgrade his background but that it would take him *four years* to get ready for college. Undaunted, Ernest found a job and worked four feverish weeks for the registration fee to attend the school.

At Kimball, Ernest plunged into his studies in characteristic fashion—aggressively and energetically. The record he established there was brilliant. He served as president of the debate society and editor of the school's paper. He completed a four-year program in three years and graduated with honors.

At Dartmouth

Ernest Just entered Dartmouth College in New Hampshire as he had Kimball—eager to learn. At first he did not find the institution to his liking because he had expected a greater seriousness among students than he found. Also, he was a bit dismayed over what he thought was an over-emphasis on football. But when he enrolled in a course in biology in a class taught by the noted biologist William Patten everything changed. More particularly, it was the teaching of Patten and the reading of an es-

say on the biological cell that stirred his imagination and profoundly challenged his disciplined mind.

For Just, Dartmouth had now become the place to be. He had found what he was looking for. The past and the present began to come into focus. Now he began to understand how science and the plants and animals in the fields of South Carolina were united. He knew what he must become, a research biologist, specializing in cytology, meaning specializing in the study of cells. Although much was already known about this marvelous microscopic living unit, it was the unknown about the cell that spurred Ernest on. After that, he took every course in biology Dartmouth College had to offer. During his senior year, Ernest spent a great deal of time in undergraduate research. In 1907, four years after he entered Dartmouth, he received the bachelor's degree. He had been elected to the Phi Beta Kappa honorary fraternity, was awarded special honors in history and zoology, and was the only person in his class to graduate *magna cum laude* (with high praise).

At Howard

In October 1907 Ernest Just went to Howard University in Washington, D. C., to teach biology at a salary of \$400 per year. There he plunged into his work with his usual energy and dedication. In 1912 he became head of the Biology Department at a salary of \$1200 and held that post until his death in 1941. In the meantime, he became a member of the faculty at the Howard University School of Medicine and head of the Department of Physiology. Here was another area of lifelong dedication for Ernest Just. He was an effective worker in his constant quest for improvement in the Howard University School of Medicine. It has been said that Just labored harder to encourage his students to go into medicine than he did to entice them into research.

Perhaps he was so dedicated to the medical school because he knew how sorely the black community needed doctors. At that time, Howard University was one of the two institutions preparing young blacks for medicine. Openings in other medical schools were almost exclusively reserved for whites.

Ernest Just, the Man

In working with his graduate students, it was the style of Ernest Just to present them with a problem and to disappear. They were left to their own initiative to probe in the laboratories and to visit the libraries of Howard and Washington for information. When he would reappear, it was to test the students on what they had learned. He held high standards before them and soon made it clear that he had no rewards for "small potato deeds." One graduate student reflected, "It was frustrating and ego-smashing, but in the end, we knew something."

In 1912, the same year he became head of the Biology Department at Howard University, Professor Just married Ethel Highwarden, a Washington, D. C., high school teacher. To them were born daughters, Margaret and Maribel, and a son, Highwarden.

Physically, Just was a tall man with brown skin and a slender build. In behavior, he was quiet, thoughtful, and somewhat of a loner. Still, some of his students remember him as a very charming man who could and did talk about "anything and everything." Sometimes they could detect a note of admiration bordering on worship for his children.

Ernest Just was held in high esteem by his students and his colleagues, who knew that he represented the institution well in the world of science. Dr. Russell Ampey of Southern University in Louisiana once said, "I, like others, viewed him with a considerable amount of awe, for we all knew he was a world authority." As a matter of fact, Ernest Just was probably the only black man of science these students had ever met who had gained national and international fame for his research and publications. He was a prodigious writer, and many of his papers had been published in foreign languages. Ampey said, "I read reams and reams of his papers. His writings were clear and concise and always well-documented—strongly backed up by evidence. That's what made him so respected."

At Woods Hole, Massachusetts

As mentioned earlier, Just's area of special interest was cytology. At that time Howard University was a predominantly undergraduate institution and sorely lacking in scientific research facilities. But beginning in 1909 and continuing until 1930, Dr. Just left Howard each summer to study and conduct research at Woods Hole on Cape Cod in Massachusetts at the Marine Biological Laboratory. (In the meantime, he also managed to compile an excellent record at the University of Chicago where he earned the doctorate degree in 1916.) Some of the greatest scientists in the world went to Woods Hole each summer to experiment, conduct research, exchange ideas and discoveries, and generally to push back the frontiers of knowledge. But Dr. Just would usually arrive at Woods Hole three to four weeks before other scientists and leave after the others had gone home.

Dr. Just could be called a pure scientist. As a matter of fact, he was called that, because he was attempting to uncover some of the basic secrets of life through a study of the unit of life structure and functions, the cell. When a pure scientist works, his major purpose is to unravel some of nature's secrets. He may not know whether his new knowledge can be of use to man immediately, eventually, or if it can be of use at all. He tries to contribute to man's storehouse of facts, concepts, laws, and theories. The role of the pure scientist is usually difficult, demanding, and

often unappreciated. But he is absolutely essential; without him, scientific and technological progress would come to a standstill.

Just, the Scientific Pioneer

As a scientist, Dr. Just quietly contributed to man's storehouse of scientific knowledge by improving our understanding of the cell. He was, first and foremost, a man of unending curiosity, a careful and close observer, and a meticulous experimenter. Dr. Just worked with marine animal eggs and sperm cells, spending a great deal of time with the sea urchins, annelids, and *Nereis*. He soon found it necessary to devise laboratory working methods and techniques so that observations and workings of these cells could be properly carried out. He blazed new trails in collecting techniques and laboratory working methods. He showed how important it was to conduct experiments using normal cells, and he became an authority on identification procedures needed to make certain that cells used in experiments met normal standards. Many scientists sought his counsel as to the best techniques they should follow in conducting their own research projects. Just always shared his knowledge and skill with others, and he did so willingly.

There was another area of interest for Dr. Just. Biologists, the scientists who study living things, have known for a long time that when a sperm cell from a male unites with an egg cell from a female, normally, a new organism begins to develop. This union is known as *fertilization*. Biologists also learned that a given egg might develop into a new organism without having been fertilized by a sperm. This became known as *parthenogenesis* (par-the-no gen-e-sis), meaning without father. Still later, biologists learned that they could cause an egg to develop into an organism by treating the egg with butyric acid and hypertonic seawater or even pricking the egg with a needle. This became known as artificial *parthenogenesis*.

While many scientists sought to learn new secrets of life by conducting research dealing with artificial parthenogenesis, Jacques Loeb of the Rockefeller Institute was a recognized authority in the field. It was he who authored the well-known *lysin theory* relating to artificial parthenogenesis. According to this theory, two substances were needed to induce artificial parthenogenesis. The treatment of the egg by these two substances could occur in either order. But Ernest Just questioned this widely accepted assumption. In his laboratory, he treated the eggs of sea urchins with seawater alone and observed that the egg proceeded to develop into a swimming larva. Moreover, he carefully examined the larvae that developed from such eggs and after careful examination found his organisms to be similar in every respect to those developed from fertilized eggs.

Biologists studied the cell and tried to determine just what role was played by its various components. They attempted to make accurate descriptions of the cell, describing the cell membrane, cytoplasm, nuclear

membrane, nucleus, and their composition. After accumulating a considerable amount of information, most scientists held the opinion that the small, centrally located nucleus was the unquestioned captain of the cell and the source of all genetic material. They asserted that the larger cytoplasm played a minor role in cell function. They concluded that the cytoplasm was used principally as a transportation artery, like a superhighway, and an enveloping material to protect the nucleus.

But Ernest Just was not yet convinced that the cytoplasm played so minor a role in cell function. In the face of opinions held by many famous people in the scientific community, he went into the laboratory to put these theories to scientific tests.

Just's behavior reveals something about the nature and proper role of the scientist. The scientist may question existing ideas and beliefs, not in an attempt to prove someone else wrong and himself right, but to determine the truth. There may be any of several reasons for raising these questions: (a) He might observe something that does not seem to agree with an existing system of beliefs. (b) He may stumble upon something new. (c) Simply for reasons he cannot explain, he may have a hunch of some sort. In the case of the cell, any research dealing with its behavior is tedious and time consuming. Long hours must be spent peering through the microscope. The researcher must be skilled in handling microscopic tools, and the living cells must be handled under conditions that interfere least with their normal behavior.

In the bodies of animals we see every day, there are billions and billions of cells, many having different shapes, making up the different parts of the body and functioning to keep the body going. In just the surface area of one square centimeter of the body, for instance, there are millions of cells.

In light of these revelations, one may ask why do scientists spend so much time observing and studying something so small, rather than the larger body. Part of the answer is that in order to best understand the workings of a body composed of a complex of cells, the logical starting point is to seek an understanding of a single cell. For the truth is, a single cell does everything the larger body does. It carries on respiration, digestion, circulation, reproduction, locomotion, and all the functions of the larger organism. Moreover, cells in groups form tissues, which in turn form organs, which in turn form systems, and the combination of systems forms the bodies of organisms.

If man understands the functions and malfunctions of the cells, he can also understand functions and diagnose malfunctions of tissues and organs. Then and then only is he armed with the knowledge and wisdom needed to treat many of the ills that plague mankind—ills such as cancer, leukemia, sickle cell anemia; diseases that cause kidney, liver, and pancreatic failure or malfunctioning; and many, many others. Thus, we begin to see how, in the long run, Ernest Just and researchers like him serve

mankind. They push back the frontiers of knowledge, a legitimate function of scientists. But they also indirectly help medical science to alleviate pain and suffering; they help geneticists to understand how certain traits are passed on from parents to offspring; and they help us all to understand ourselves better.

Getting back to Just: He had questioned the views held by most scientists of his time about the role played by the cytoplasm in total cell operation. As you may recall, that view was that the cytoplasm played a minor role in cell functioning and cell reproduction. But Just knew that hunches, guesses, and speculation were only a first step in challenging existing and strongly held views. He knew it was important to clearly understand what he was looking for and to develop experimental approaches that would put his ideas to severe tests. Already, over a period of many summers at Woods Hole, he had developed and refined experimental techniques needed to conduct such a study, and he was an acknowledged skilled scientific workman in the field of cytological research. So, Dr. Just went to the laboratory. Armed with his understanding of cell structure and functioning, his research knowledge and skill, and the patience and dedication which the tasks demanded, he was eventually able to present evidence that:

1. The ectoplasm (outer layer of the cytoplasm) is just as important as the nucleus. The living cell depends upon smooth cooperation between the nucleus and the cytoplasm.
2. Because of its closer relationship to the external environment, the ectoplasm is primarily responsible for the harmonious development of the cell.
3. The fertilization of an egg is not solely dependent upon the union of the nucleus with the sperm, but is also dependent upon the conditions of the cytoplasm.
4. Without the presence of the ectoplasm, egg fertilization could not take place at all.
5. Polyspermy, a condition which takes place when more than one sperm penetrates the egg, takes place when the ectoplasm is slow in reacting.
6. The interplay between the nucleus and cytoplasm of the cell is constant and mutual.
7. The ectoplasm is keyed to the outside world as no other part of the cell. It stands guard over the inner living protoplasm.
8. Heredity factors are located in the cytoplasm; and the genes, which are found in the nucleus, merely function to extract material containing these hereditary factors from the cytoplasm.
9. The ectoplasm plays an important role in the intake and output of water from animal cells.

After 25 years of research and study, Just declared: "The cell nucleus is not the sole structure that is responsible for heredity, but the

cytoplasm and especially the ectoplasm influence on the structure and function of the nucleus is so great as to share equal responsibility."

Additionally, Just's findings forced biologists to reconsider their thinking on the real differences between living and nonliving things, ways of determining sex before birth, some keys to evolution, and the difference between plant and animal life. He wondered about such things as whether or not magnetism would affect division of eggs following fertilization. Years later, space scientists sought answers to this same question by sending eggs of sea urchins, among others, aloft in a spacecraft that passed through the earth's magnetic belt.

His Publications

Another activity of a scientist is publication. This is done in order to share findings and thinking with other investigators as well as to invite their reactions to the work. Sometimes these are critical reactions but they usually serve the purpose of helping to determine the truth. Dr. Just, in his clear and concise writings, was always careful that his publications were backed up by evidence. He wrote two books, *Basic Methods for Experiments on Eggs of Marine Animals*, essentially a book of techniques, and *The Biology of the Cell Surface*, a book that presented much of his research and thinking about the cell. He was also a contributing editor to *General Cytology* and another work on colloid chemistry by Jerome Alexander. He served as associate editor of the *Biological Bulletin*, *Journal of Morphology*, *Physiological Zoology*, and also *Protoplasma* of Berlin. His first paper appeared in 1912. In this fascinating paper, Just demonstrated rather ingeniously that the way the egg of an animal called the *Nereis* developed depended on the point of entrance of the sperm. He published more than sixty papers, a number of them appearing in foreign journals.

In Europe

Ernest E. Just received many recognitions during his lifetime. At some institutions like Southern University in Baton Rouge, Louisiana, Dr. Russell Ampey, a former student of Just's sponsored a biology club called the E. E. Just Biology Club. Dr. Just was the first recipient of the Spingarn Medal, an award presented annually by the National Association for the Advancement of Colored People in recognition of an American citizen of African descent for highest achievement in an honorable field of endeavor. In 1923 at Howard University, the school's annual, *The Howard Bison*, was dedicated to him.

But there was one recognition that never came to Ernest Just. Except for the biological laboratories at Woods Hole, he was never invited to conduct research studies at any of America's well-equipped and notable laboratories. The racial climate of that period did not encourage that

such an invitation be extended to a black man. However, he was invited to serve as a guest worker in the Kaiser Wilhelm Institute for Biology in Germany. At that time, this was considered to be perhaps the greatest research laboratory in the world in the fields of physics, chemistry, and biology. Similar invitations came from the Sorbonne in Paris and the Zoological Station in Naples, Italy.

Ernest Just's life came to an end October 27, 1941 when he was 58 years old. He died of cancer. But his contribution to a greater knowledge and understanding of the cell will someday help mankind to conquer this and other dreaded diseases.

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GARRETT AUGUSTUS MORGAN



Big Chief Mason,
Ingenious American 1877-1963

Gossie Harold Hudson

HE WAS tired, exhausted, and for the moment, not particularly concerned with the color of a man's skin. J. T. Metz was a hard worker, and like his co-workers, he was blunt, and often spoke in the vernacular. "Damn it!" he exclaimed. "What is the use of fighting fires all night when you can do the work in fifteen minutes? Two men equipped with the Morgan helmet and a good fire extinguisher can accomplish more in fifteen minutes than a whole company can in the next thirty minutes. . . . I have used the Morgan helmet in my department for over a year and it has given me great satisfaction in assisting me in saving human lives and property, and I am sure it has saved our city many thousands of dollars. . . ."

In the 1910s Metz was an Akron fire chief who made a practice of carrying a couple of Morgan's safety hoods in his car. Morgan was a black man who had invented a protective helmet or hood for fire fighters to protect them from smoke. Because Morgan was a black man he used

ingenious methods for promoting his safety helmet. Although he preferred to demonstrate his device personally, he employed white men to carry out demonstrations in the Southern cities. He himself usually assumed the disguise of an Indian chief in order to show, successfully, the effectiveness of his inventions. For example, the New Orleans *Times-Picayune* of October 22, 1914, reported a demonstration in a "sulfur" tent. A canvas tent was erected in an open space, and inside the tent a fire was started. The chemicals in the fuel and the character of the smoke made for the most evil-smelling substance imaginable. To climax the demonstration, "Big Chief Mason," labeled by a newspaper story as a "full-blooded Indian from the Walpole Reservation in Canada," entered the smoke-filled tent geared up with his own invention, a safety hood. He remained there for 20 minutes with no apparent ill effect. "Big Chief Mason," who was no Indian at all, believed that the adoption of his invention by a prominent city like New Orleans would add vitally to his success as an inventor. The reason for the Indian disguise was that Morgan thought it best not to reveal to the officials that the safety hood had been designed by a black man.

To the benefit of all Americans, Morgan did not stop with the safety hood, he invented the gas mask, a belt fastener, a round belt fastener, a friction clutch, and developed an automatic traffic light that controlled traffic in all directions at one time. This made it possible for automobiles to move along in order and safety. Thus, his inventive genius not only saved lives, but helped to produce a little more organization in our society. Spending his entire life saving others, he was a great man, a great humanitarian, and will be remembered as a prolific inventor and an ingenious American.

Move to Ohio

Because Morgan was both self-educated and creative, it is not surprising that his inventions and work were complicated and technological. Still, one wonders how such remarkable achievements could have come from an individual whose only formal education ended in the elementary school.

The seventh of eleven children, Garrett Augustus Morgan, was born to Sydney and Elizabeth Morgan on March 4, 1877. There were few educational advantages for the lad because his hometown of Paris, Kentucky, in the eastern region of the state, was mountainous and poor. It came as no surprise when Morgan left school in the fifth grade at the age of fourteen. This was rather typical in his community.

"No need to stay in Kentucky," the young man pondered, "I believe I'll go across the mountains and look for a job." Arriving in Cincinnati, he obtained a job as a handyman. This satisfied him for a while; but in 1895, still broke and still hopeful, he moved to Cleveland where he ac-

cepted a job as a sewing machine mechanic with Roots and McBride. In the next few years, he worked for several sewing machine companies.

The years following saw the productive genius of Morgan reach full bloom both in invention and business. In 1907, he opened a sewing machine shop and a repair shop. The next year he married Mary Anne Hassek, a marriage that blessed him with three sons, John Pierpont, Garrett, Jr., and Cosmo Henry. By 1909, he employed thirty-two workers in a tailoring shop that manufactured dresses, suits, and coats. Here he discovered the first human hair straightener which was marketed as the G. A. Morgan Hair Refining Cream.

Morgan invented the Safety Hood, later known as the gas mask, in 1912. He referred to it as a "breathing device," and described the hood as an invention "to provide a portable attachment which will enable a fireman to enter a house filled with thick suffocating gases and smoke and to breathe freely for some time therein, and thereby enable him to perform his duties of saving life and valuables without danger to himself from suffocation. The device is also efficient and useful for protection to engineers, chemists, and working men who breathe noxious fumes or dust derived from the materials with which they work." The patent, granted in 1914, is U.S. Patent number 1,113,675.

The same year he won the First Grand Prize gold medal at the Second International Exposition of Sanitation and Safety in New York City. Afterward, the fire departments of several large cities in Ohio, Pennsylvania, and New York used the device. Morgan improved the mask to the point where it was used successfully on the battlefields in World War I, saving thousands of American soldiers. In fact, the gas mask became part of the standard equipment of field soldiers and has been used in subsequent wars.

Rescue under Lake Erie

An unfortunate occurrence in 1916 allowed Morgan to present an impressive demonstration of his major invention. The tragic occasion brought Morgan and his brother Frank at 2:00 A.M. on July 25, to a tunnel where two dozen men were trapped 5 miles out and 228 feet below Lake Erie and the Cleveland Water Works. The brothers, assisted by two volunteers, quickly donned their inhalators and stumbled through the smoke, debris, and a dense mixture of natural gases and dust. Down they descended, over 200 feet into suffocating darkness, where they gathered up a body and returned to the surface via the tunnel's elevator. Again and again, they made the trip saving more than twenty of the otherwise doomed workers. For that heroic rescue, the city of Cleveland awarded Morgan a solid gold medal. Moreover, the well-publicized feat brought him before the public. As a result numerous manufacturers and

fire departments showed keen interest in his inventions, and he was requested to demonstrate his device in various cities and towns.

During these years, Morgan set up his own company to manufacture and sell the hoods, although in the South he had to employ a white man to demonstrate the invention. Orders for the device soon stopped when the racial identity of the inventor was known. Success did not come easily to Morgan, or to any blacks of that time. But Morgan, like scores of blacks before him (Norbert Rillieux, the sugar refining process; Elijah McCoy, lubricating device; Jan Matzeliger, the shoe lasting machine; Granville Woods and the introduction of the telegraph system), was not easily discouraged even if it meant pretending to be an Indian and using white demonstrators. Thus, through a combination of brains, determination, and guts, he and other inventors succeeded despite the racial injustices of the times.

A Concerned Black Man

Morgan's thinking never stopped, nor his inventive genius. With the growing number of automobiles on the streets and the attendant accidents, his fertile brain now turned to the possibility of yet another safety device. "Why not have electric light signals at intersections, with different colored lights as signals for stopping or going," he thought. Finally he devised an answer, and the first traffic light signal system was born. He sold the rights to his signals to General Electric for \$40,000. By this time his friends included John D. Rockefeller, Sr., and J. Pierpont Morgan.

As a concerned black man who took the problems of his people very seriously, he participated in a wide variety of civic affairs and civil rights activities. In the 1920s he started the *Cleveland Call* (today the *Call and Post*), to dramatize the omission of blacks in the traditional communications media. Also, Morgan was a charter member of the Cleveland Association of Colored Men, organized in June 1908. He served as treasurer of the CACM until it merged with the National Association for the Advancement of Colored People (NAACP). Recognizing the disadvantages that the local black community had to contend with, the group proposed to advance the varied interests of the black people of Cleveland.

Desiring a more active role in the struggle for black rights, Morgan ran as an independent candidate for the City Council in Cleveland in 1931. "If elected," he promised, "I will try to lead the people of the third district to equal representation in the affairs of city government." Further, Morgan's platform included relief for the unemployed, improved housing conditions, and more economic and efficient administration of public affairs. The inventor lost the election, but not his interest in humanity, which he continued in the realm of education.

No one will ever say that the man's lack of education interfered with

his interest in academic affairs. At Cleveland's Western Reserve University the inventor organized a fraternity of black students despite the fact that he himself possessed only a fifth-grade education. President Charles F. Thwing of Western Reserve, at a testimonial banquet attended by the Honorable Thurgood Marshall in 1953, said that Morgan was "a great Clevelander, one who has achieved greatness because he was willing to dig, in spite of his limited education."

Only a few years before the mid-1940s, Morgan had glaucoma and by the time of the testimonial he had less than 10 percent vision. Yet he remained active even to the point of observing his own inventions in an exhibition just a few weeks before his death. He died on July 27, 1963; and in 1967, the Shriners' national convention in Cleveland dedicated a plaque of Morgan which stands today in the Hall of Fame of the Cleveland Public Auditorium.

No commentary on American inventors should fail to mention the major accomplishments of the ingenious black Americans who often achieved in the face of overwhelming odds, but were frequently rewarded with hostility and derision. The records show that Garrett Augustus Morgan spent a lifetime helping and saving others. Prepared with a mere pittance of education, he made lasting and noble contributions to his fellowman and to mankind. His perseverance, stamina, and success against the odds of racism, poverty, and ignorance will always remind people everywhere that black and poor are not necessarily synonymous with failure.

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GEORGE WASHINGTON CARVER



Agricultural Scientist (about) 1864-1943

Exyie C. Ryder

SOON after the Civil War, a young black boy named George discovered that his "parents" were a German immigrant couple named Moses and Sue Carver.

George, or the Carvers' George as he was often called in Diamond Grove, Missouri, where he was born, was small for his age, quiet and soft spoken. In addition, and probably most important, he was curious, observant, and keenly perceptive. In moments of loneliness he often wondered about his real parents and how he, a black boy, happened to be living with the Carvers. But he was almost a young man before he learned anything at all about his early life. One day his older brother, Jim, told him the sad story.

Their mother, Mary, had been a slave on the Carver plantation, while their father was a slave of a family that lived nearby. The two sons, George and Jim, lived with their mother. One cold wintry night a band

of nightriders invaded the Carver plantation to steal Mary and her sons. Nightriders were men on horseback who roamed the countryside after dark raiding plantation slave cabins to steal slaves from their owners. Although the Carvers tried desperately to save Mary and her sons, the powerful nightriders were successful in capturing Mary and her infant son, George, who was sick with whooping cough at the time. When the raiders realized how frail and sick young George was, they left him beside a tree to die and made their getaway with Mary only.

The following day, young George was found alive and returned to the Carvers in exchange for one of Moses Carver's valuable race horses that was worth three hundred dollars! Saddened by the loss of Mary, the Carvers were nevertheless delighted to have little George back. They were kind to the boys and cared for them in the absence of their real mother and father. The traumatic event resulted in the permanent separation of the mother from her two sons.

By the age of six or seven, George was working very busily in and around the Carver house, in the barn, and in the fields. During this time, he developed an unusual fondness for plants, maintained a beautiful flower garden, and made daily trips to the woods to learn more about wild flowers.

Though George derived tremendous knowledge and satisfaction from his nature studies, he still wanted most of all, books and knowledge. He hoped someday to learn to read, write, and figure, and eventually to obtain a college education. But being black in an all-white town thwarted his dreams of attending school because there were no schools for colored children in Diamond Grove, Missouri.

School at Last

When George was only ten years old, he was faced with making his first major decision. One day, he informed the Carvers that he was planning to move to the next town, eight miles away, in order to attend school. Naturally, Moses and Sue Carver were reluctant to approve of George's leaving home at such a young age. But when he was ready to depart, they packed a lunch for him and wished him well. He left Diamond Grove with only a lunch, the clothes he was wearing, and a strong determination to learn to read and write.

A few days after arriving in the town of Neosho, George met a black couple, Andy and Mariah Watkins, who invited him to come to live with them while he attended a school near their home. Aunt Mariah and Uncle Andy, as George affectionately called them, grew very fond of young George and treated him as a son. In turn, George was delighted to be living in such a warm and friendly, religious home and was especially happy to meet and be associated with black folks for the first time in his life.

George enrolled in the overcrowded one-room school, studied diligently, and learned very rapidly. Though he met other children his age, his shyness and small size prohibited him from acquiring many friends and playmates. Consequently, he spent most of his time studying, and occasionally he read passages from the *Bible* to Aunt Mariah and Uncle Andy.

It wasn't long before George realized that he had learned just about as much as his teacher in this small school was capable of teaching him. So he decided that if he were to continue his formal education, he must find a more challenging school. Leaving Uncle Andy and Aunt Mariah was not easy, but George's desire to prepare himself for admission to college enabled him to set out for Kansas and try living alone—working and attending school whenever and wherever possible.

For a while, he found and held numerous jobs in exchange for a place to stay. As usual, he spent his spare time reading. In Minneapolis, Kansas, he lived with and worked for a couple, the Seymours, while completing his high school education. Upon receiving his diploma, he applied for admission to Highland University. In response, he received a letter from the president of the university stating that he had been accepted as a scholarship student for the fall term. With this news, George was happier than he could ever recall. That summer, he returned to Diamond Grove to visit the Carvers and to inform them of his finishing high school and his plans for college.

In the fall, George reported to Highland University and presented his letter of admission to the president, who then looked at it and assured Carver that a mistake most certainly had been made, because Highland University did not admit Negroes. Of course, George was surprised, disappointed, and deeply shaken, for he had so eagerly looked forward to entering college all his life. Feeling dejected and rejected, he quietly walked away—now thinking only of finding a job and a place to stay.

College in Iowa

In a couple of years, George had recovered from the bitter experience and was once again contemplating a college career. He was granted admission to Simpson College in Iowa, and again he worked at odd jobs to sustain himself and studied during his spare time. At Simpson, Carver excelled in the arts and sciences and was highly regarded for his ability and talent in both areas. As time passed, he gradually showed more interest in the sciences and decided to pursue a major in the agricultural sciences. Soon after he made this decision, his professors at Simpson College advised him to transfer to Iowa State College of Agriculture and Mechanical Arts (now Iowa State University), where they felt his talents and interests in the agricultural sciences could be more fully developed. Carver heeded their advice and enrolled in Iowa State. When he received

the Bachelor of Science degree in 1894, he was offered a faculty position at the College. This was indeed a surprise to him, for he had encountered more than his shares of struggles and setbacks most of his life.

Carver accepted the appointment as assistant professor of botany and agreed to serve on the faculty while he worked toward a master's degree. His appointment marked the first time a black was ever to hold a faculty position at Iowa State. One of Carver's responsibilities at the College was to oversee the operation of the greenhouse—an assignment he enjoyed because it afforded him the opportunity to remain in daily contact with plants.

One day, a letter arrived for Professor Carver from the great Dr. Booker T. Washington, President of Tuskegee Normal and Industrial Institute for Negroes. It was an invitation for Carver to join the faculty at Tuskegee Institute in Alabama and head the agriculture program. Carver was momentarily stunned, but quickly knew that he would accept the offer because a desire to help black people had been foremost in his mind for a long time. Regarding this offer as his opportunity, he did not hesitate to leave the well-equipped laboratories and libraries at Iowa.

Beginning at Tuskegee

Carver arrived in Tuskegee in 1896 at the age of thirty-two. He was very much impressed with the all-black college, its philosophy of work and study, and the profound interest in learning that the students and the community people displayed. On the other hand, he was dismayed at the poverty, illiteracy, and poor health that made life so difficult for blacks in rural Alabama. Excited at the prospect of working with students as well as with the local farmers, Carver was eager to begin his work.

When he was shown the agriculture department—a few chickens, a barn, and a cow—his thoughts inevitably went back to the elaborate facilities of the agriculture department at Iowa. But he pushed the thoughts aside and instead tried to think of ways in which he could help improve the quality of black life in the southern states.

As a professor, Carver was a model scholar and scientist to his students. He encouraged them to view education as a means toward improving one's health and standard of living. Use of the term "scientific agriculture" in lieu of "farming," made Professor Carver's department the most popular department on the campus. Within one semester, the departmental enrollment jumped from thirteen to seventy-five. Farming had at last become a dignified and respectable major, and students no longer associated it with the drudgery of slavery.

The first months at Tuskegee, Carver spent thinking about the enormous job to be done and how to go about doing it. He taught his classes and worked diligently in his laboratory, which at that time was nothing more than an assemblage of improvised equipment—much of it

made from junk which he collected enthusiastically. Since Carver was both imaginative and resourceful, he was able to construct the basic apparatus he needed for his laboratory.

His first major undertaking at Tuskegee was that of studying the farmland in the area in an effort to determine what treatments would be necessary in order to make the worn-out soil respond favorably to farming. With his expertise on soil and plants, he quickly concluded that the continuous planting of cotton in the same soil year after year had upset the balance of soil nutrients, severely damaged the topsoil, and caused even the annual cotton crop to diminish. A subsequent and thorough scientific analysis of the soil indicated a nitrogen deficiency. Almost immediately, Professor Carver recalled that members of the pea family were capable of extracting nitrogen from the air and putting it back into the soil. As a result, he soon began to experiment with different kinds of peas, which eventually led to his familiarity with the peanut and the many experiments with it that followed.

Crop Rotation

After a couple of years of crop rotation and soil treatment, Carver was able to show the large healthy vegetables and big fluffy cotton that grew from the same hard clay that the local farmers had damned. Everyone was surprised, and some even reacted with disbelief! But they were all eager to learn how they, too, could grow such plump crops.

In an effort to reach the rural farmers who, of course, could not read, Carver organized extension classes in the nearby counties. Once a month he journeyed on horse and buggy to an area of the state to show the farmers how to farm scientifically. He introduced the concept of crop rotation; urging the planting of peanuts and cotton on an alternate basis. He explained to the farmers that the peanut was high in nutritional value, for it contained protein and that it was a leguminous plant, capable of enriching the nitrogen-deprived soil.

On each visit to a particular county, Carver held classes for the farm wives in order to demonstrate methods of preserving foods for use during the winter months, menus of well-balanced meals, and recipes for preparing tasty dishes that were high in food value. Many of the recipes called for weeds—herbs and spices that were abundant in the area, but about which very little was known. Consequently, whenever a new dish was introduced, it was necessary to demonstrate its preparation and invite all the women present to sample it.

Strangely enough, the common garden tomato had never been used for food by the local families until Carver sliced one in class, ate it, explained its nutritional value, and allowed the farm wives to sample several different dishes in which he had used the home-grown tomatoes.

Praise the Peanut

Professor Carver labored relentlessly collecting specimens from the woods in the early morning, and afterwards working long hours in the laboratory. With the peanut, he made more than 300 products; among them, cheese, buttermilk, flour, paper plastics, and stains. Experimenting with the sweet potato resulted in such products as syrup, flour, starch, and stains along with a hundred others. From other sources, he made paints, dyes, face powder, and numerous prototype medicines.

One could very well say that Carver was, during his time, a true conservationist, for he collected and recycled every obtainable piece of trash, garbage, and rubbish. With his brilliant scientific mind, he utilized anything that was discarded to produce a worthwhile and useable product.

It wasn't long before he had earned the name of genius. Word of his accomplishments in rural Alabama spread rapidly. Profits from cotton soared enormously, and numerous healthy food plants sprang from fields and gardens all over the Southeast. The improved diets gradually alleviated the malnutrition that afflicted a large number of people in the southern states. Professor Carver at Tuskegee had won the respect and admiration of both the black and white people across the nation.

As expected, Carver's brilliance attracted the attention of such famous men as Henry Ford and Thomas Edison, each of whom made lucrative offers of money, promised lavish working facilities and instant fame, all in an attempt to lure Carver to work in their laboratories. All such attempts proved futile, for Carver had an overwhelming determination to remain at Tuskegee where there was a job to be done and he was needed.

In 1921, he appeared before the Congressional Ways and Means Committee in Washington, D. C., on behalf of the United Peanut Growers Association. A splendid and most impressive demonstration of the peanut and its possibilities was responsible for the passing of a bill, by Congress, which imposed a heavy tax on peanuts that were imported from foreign countries. The passage of such a bill was necessary because the peanut, by this time, had become a lucrative crop of the southeastern part of the United States, and every effort was being made to discourage its importation from other countries.

Honors

During the 1920s and 30s, Carver continued his laboratory work at Tuskegee and developed hundreds of new products from very common resources. For a brief period, he went to Dearborn, Michigan, and worked in a well-equipped laboratory provided for him by Henry Ford. In the meantime, he wrote numerous bulletins and pamphlets for farmers and housewives informing them of up-to-date improved methods of farm

living and advising them on the use of many available products. Very frequently, he was invited to address audiences in some of the country's leading universities.

Though many people prefer to think of Carver as an agricultural chemist or botanist, he could very well be called an artist, a concert pianist, a chemist, a pharmacist, or a weaver—as evidenced by his oil paintings, stains, dyes, needlework, food preservation techniques, and prototype medicines.

Many citations and honors were bestowed on him here and abroad for his outstanding achievements and distinguished career. As early as 1916, he was elected a fellow of the Royal Society of Arts in London, England. Then in 1923, he was awarded the Spingarn Medal by the National Association for the Advancement of Colored People. This is a medal given annually to a black individual recognized for extraordinarily high achievements.

In 1939, Carver received the Theodore Roosevelt Medal for distinguished research in agricultural chemistry. From Simpson College in Iowa and from the University of Rochester in New York, he was awarded an honorary Doctor of Science degree. And finally after more than thirty years of accomplishments in the field of agriculture, in 1935 he was named a consultant to the United States Department of Agriculture.

The 1936-37 school year marked Carver's fortieth year at Tuskegee Institute. The entire community participated in a year-long celebration honoring him for his outstanding contributions and service to mankind. Professor Carver's service was unusual in that during his long tenure at Tuskegee Institute, he never accepted his salary. Living very sparsely, he spent very little even for necessities such as food and clothing. Since he never married and had no family, he apparently decided to dedicate his services to humanity.

In 1940, the George Washington Carver Foundation was established, while preparations were being made for the Carver Memorial Museum, a two-story structure presently located on the campus at Tuskegee. The museum is replete with hundreds of ingenious artistic and scientific products which are evidence of Carver's versatility and resourcefulness. Among them, one can find intact jars of food preserved more than sixty years ago, an artificial marble bench, shoe polish, dyes, lace tablecloths, macramé designs, paintings and sculpture, and numerous products from the peanut. Copies of some of the honors, awards, and letters of tribute to Dr. Carver are also there. One of the highlights of the museum is the replica of his laboratory.

Carver has been memorialized in various institutions and theaters. Dormitories, ships, and scholarships are examples of the kinds of things that have been named in honor of him. Three species of fungi which he discovered during his experimentations in plant pathology also bear his

name. They are *Collectotrichum carveri*, *Metasphaeria carveri*, and *Taphrina carveri*.

Because of his excellence and outstanding achievements, Tuskegee Institute received world recognition. This quiet college community grew accustomed to having famous personalities such as the Prince of Wales and President Theodore Roosevelt visit the campus to pay tribute to Professor Carver.

On January 5, 1943, George Washington Carver died in his room on the campus. He had been a victim of failing health for several months. Since his death, hundreds of people continue to visit the museum each year to observe first-hand the amazing results of Carver's work.

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BENJAMIN BANNEKER



Black Astronomer 1731-1806

W. Sherman Jackson

THE achievements of Benjamin Banneker in science, mathematics, and astronomy have been argued often as being symbolic of what black Americans could have accomplished if given the opportunity. That Banneker was self-educated makes his life and achievements even more significant. In order to explain what motivated Banneker to devote his entire life to the study of natural sciences, it is necessary to delve into his early boyhood.

Benjamin Banneker was born to Robert and Mary Banneker on November 9, 1731 in Baltimore County, Maryland; the Bannekers had married a year earlier. In addition to Benjamin, the Bannekers had two daughters, Minta and Molly; the latter being named after her maternal grandmother who was English.

Significantly, the Bannekers were free blacks in a state which had legalized African slavery as early as 1663. Despite a 1664 Maryland ban

which declared that baptism was not equivalent to emancipation, Robert Banneker, a native of Guinea, West Africa, had received his freedom through baptism. His wife Mary had been born free. Her mother, Molly Welesh, who was English, had married one of her former slaves. He was an African prince called Banneka. Usually it was a common practice of slave owners, ignorant of the native names of their African slaves to name Africans in the European tradition, using first name only. Molly ignored this practice and allowed her slave and future husband to keep his African name. Eventually through misspelling the name Banneka went from Banneky to Banneker. Having no surname, Robert adopted the name of his father-in-law, Banneker.

Robert and Mary Banneker were good parents to their children. They worked long and hard on their 120-acre farm, located in the wilderness, 10 miles from Baltimore, to provide the daily necessities of life for their family. When they were old enough, Benjamin and his sisters also worked to help produce tobacco, corn, and other staple crops. The tobacco was sold at the local general store in exchange for food, clothing, and other items of family necessity.

Life on the farm was hard work for Benjamin, but he was never reluctant to do his share of the chores, which included corn planting and feeding the livestock and poultry. Whenever time permitted it, Benjamin and his father would hunt and fish to supplement the daily family diet. Some of the game they hunted were wild geese, ducks, rabbits, squirrels, turkeys, opossums, and raccoons. Sometimes Mr. Banneker traded the animal pelts for needed commodities.

Mathematics

At other times when he was not needed on the farm, Benjamin attended one of the few private schools in Baltimore County. He was one of several black students in his class. Unfortunately he did not attend school very long because the farm chores became too demanding to allow Benjamin the privilege of remaining in school. Despite his brief stay in school Benjamin did learn the rudiments of an elementary education from his Quaker schoolteacher. Both on the farm and in school he displayed a very strong interest in mathematical problems. At times he would create imaginary problems to solve as a way to break the monotony of farm life. He was a very observant boy with a remarkable memory.

As time passed, Benjamin could no longer attend school but continued his education through borrowing books. He also spent many joyous hours reading and discussing the *Bible* with his maternal grandmother Molly Welesh Banneker. She was most influential in helping Benjamin to develop educationally. Although Benjamin did not buy his first book until he was thirty-two years of age, he was by this time a self-educated man. In addition to reading mathematics books, he read the

works of such distinguished writers as Addison, Pope, Shakespeare, Milton, and Dryden.

Benjamin's life as a youth did not involve the usual interests of a growing boy. He was a very serious-minded person and submerged himself in books whenever possible. Mechanics and mathematics were his constant companions during his boyhood and throughout most of his adult life. At the age of twenty-two in 1753 he used his mathematical genius and mechanical mind to invent a perfectly designed and workable wooden clock. Prior to this remarkable invention he had only seen one watch, which he memorized. Then using his mechanical skills, ingenuity and perseverance he constructed a clock which kept perfect time for nearly twenty years. It was the first clock of its kind to be produced in colonial America. It attracted many visitors to the Bannekers' home and remained one of their most valuable items. When his father died in 1757, Benjamin became sole heir of the family farm because his father feared that being black could create many unnecessary legal problems for his wife and children which could have resulted in their losing the farm.

Writing an Almanac

Banneker had to budget his time wisely in order to continue farm productivity and his pursuit of the natural sciences. His interest in the natural sciences was brought to the attention of many people. One such person was George Ellicott, a businessman and amateur scientist. Ellicott had built several flour mills in 1772 near the Banneker farm, and his interest in astronomy made him and Banneker lifetime friends. Banneker's friendship with Ellicott stimulated his interest in astronomy, and at the age of fifty-six he began the study of astronomy. In the years that followed Banneker mastered the fundamental principles of astronomy, much to the surprise and pleasure of Ellicott. He could, for example, project forthcoming eclipses with extreme accuracy. Conscious of how important astronomy was in farming, Banneker began preparation of an almanac to be used in the states of Maryland, Virginia, Delaware, and Pennsylvania. He published his first almanac in 1792, and for the next 10 years he continued to publish this indispensable pamphlet. Almanacs were first introduced in colonial America in 1639 and played a very significant role in a society where nearly everyone lived on a farm. In addition to calendars and information on heavenly bodies, these early almanacs contained information on astrology, history, literature, and poetry. Everybody in colonial America relied on almanacs for reliable information.

Because it was indispensable in colonial life, Banneker's almanac was a most welcome contribution. It soon became as popular as Benjamin Franklin's *Poor Richard's Almanac*, published years earlier.

Banneker sent one of the first copies of his almanac to Thomas Jefferson, United States Secretary of State under President George

Washington. Jefferson believed blacks were too inferior to accomplish anything significant, but Banneker hoped that once Jefferson appraised the almanac he would no longer adhere to his views of racial inferiority. Upon completion of the almanac Jefferson congratulated Banneker for his attempt to prove that nature had given his "black brethren talents equal to those of the other colors of men." Jefferson felt the inferiority of blacks resulted from the degraded condition of their existence in America and Africa and wished that an effective system could be developed to elevate their conditions of the body and mind as "fast as the imbecility of their present existence would admit." Jefferson then commented he had sent his copy of the almanac to be placed in the French Academy of Sciences because he believed it was a document which blacks could use to help justify their abilities against doubts which were entertained about them.

Earlier, Jefferson had approved the appointment of Banneker as one of the assistants to survey the proposed site of what is now Washington, D. C., a project which was started in 1791 and completed in 1793.

Banneker's success as mathematician, astronomer, and surveyor was achieved through many personal sacrifices. He never married and depended upon his married sisters who lived nearby for clean clothing and cooked meals. Banneker usually worked throughout the night and slept during the day. Those unaware of his research and fame criticized him as being lazy, but this he simply ignored. His devotion to scientific research made him a social recluse, who had few, if any close friends. Among the few pleasures he enjoyed were pipe smoking, working his orchard, and playing the violin, an instrument he had taught himself to play.

Banneker became so absorbed with his scientific research that he found farming too demanding and eventually leased his land to several farm families to help supplement his meager income. Wealth did not accompany the fame he achieved. Banneker was often compared to Benjamin Franklin who also engaged in scientific research and published almanacs. Banneker died in 1806, an American scientist whose color made him a forgotten man.

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PERCY L. JULIAN



Soybean Chemist 1899-

Edward S. Jenkins

CASTING furtive glances about him to see if anyone were looking, the young boy raced quietly up to the fence that separated him from the school beyond. Pulling himself up, he peered across the schoolyard into the open windows of the school and tried to make out just what those youngsters were doing who were lucky enough to be enrolled in a high school chemistry class. As he watched one student heat an unknown substance in a test tube, the wistful youth wondered if someday, somewhere he might be able to enroll in a course in chemistry.

For a while he imagined himself in that school, learning, having fun with science. Then he shifted his attention to another area of the classroom to see if students there were doing anything different. But suddenly a harsh, authoritative voice jolted him back to reality. "Hey you boy, get away from here—and fast!" The youngster looked around. A policeman was reaching to pull him down from the fence. Quickly he released

his hold, dropped down and raced away—away from the fence, away from the school, and away from the chemistry class.

The young boy, Percy Julian, was black. The high school where the Montgomery, Alabama, lad lived was for whites. As a matter of fact, there was only one public high school in all Alabama for blacks to attend (way up in Birmingham), and it was overcrowded, had no real laboratory, and was hardly the place for Percy to get a start in science.

Percy, who was born in Montgomery on April 11, 1899, also lived in a community where few, if any had ever heard of a black person who was a chemist. Teacher, yes; lawyer, well . . . yes; physician, certainly. But a chemist . . . why what could young Percy be thinking about? The boy was a foolish young dreamer.

But young Percy's father was a proud man. He labored long and hard for his family and was determined that his children would have every educational opportunity that he could afford to give them. In the meantime, he stressed hard work and excellence. Once, while in grade school, young Percy had rushed home to his father and proudly showed the elder Julian a paper his teacher had graded and returned to him. It had a score of 80. Mr. Julian knowing that his son was capable of doing better, lectured the boy that he must never be satisfied with mediocrity. An 80 was mediocrity. Next time Percy was to make a 100.

When Percy was ready for high school, Mr. Julian sent him to the State Normal School for Negroes. Julian's record there was good—so good in fact that he was awarded a scholarship to attend DePauw University in Indiana. When the important day for departure arrived, the family gathered at the train station to "send their boy off." As the locomotive gathered steam to head north, Percy waved good-bye. Standing on the platform and waving in return was his 99-year-old grandmother whose nimble fingers had once picked a record 350 pounds of cotton in one day. There was his grandfather, waving a hand with two fingers missing, lost because his slave owner had cut them off when he discovered the black man had learned to read and write. His mother was there, regretting to see her son go, but wishing him well. Then there was his father whose good-bye salute seemed to say, as one writer put it, "Make it 100, son, make it 100."

At DePauw

Despite his attendance at State Normal, DePauw considered Julian's background so poor that he was required to take certain high school courses and a full college load for the first two years he was there. In the meantime, to help support himself, the young man worked in a fraternity house and slept in the attic. Still he was able to finish college in four years, capture Phi Beta Kappa honors, and graduate as valedictorian of his class.

Julian's success had a pronounced effect upon the rest of the family. Inspired, his mother moved to Greencastle, Indiana, so that it would be easier for the other five sisters and brothers to attend college. To make all this possible, their railroad mail clerk father remained in Montgomery where he continued to work and send support money to the family. The other Julian children also did well, eventually earning some fourteen college and university degrees.

A Letdown

As a student and chemistry major in college, Percy Julian had established a record that even his "make it 100" father could approve. Hard work and dedication it seemed, had paid off. Now he began to look forward to another opportunity that he just knew was soon to come his way.

It had been a long-standing and continuing custom at DePauw, that the chairmen of departments would recommend their better students for scholarships to do graduate study. Based on his record, Percy believed he would soon hear of a graduate scholarship offer. In the meantime, the more able chemistry students were telling each other, and Julian, where they were going next year . . . to Illinois . . . to Michigan . . . to Ohio State . . . But Percy, they said, would surely get one of the very best offers. Perhaps they were holding the best for last such as a Harvard or Yale or University of Chicago scholarship.

In the meantime, an anxious Julian waited. And waited. No word. He waited some more. Nothing.

Finally the young man could bear the suspense no longer. He decided he would go to Dr. Blanchard, the chairman of the department. Upon seeing his pupil enter the office, the older man welcomed him in. He had been expecting him. He thought he would come. Yes, he had written off in search of scholarships. Holding up a handful of letters, Dr. Blanchard told the younger man that he had received several replies. Trouble was, none of the institutions was willing to accept Julian. They said it would be a waste of resources to provide graduate education in chemistry for a black student because neither industry nor the major universities would accept him if they did. One of them suggested that Blanchard tell his "bright colored lad" to go south and teach in a Negro college because he "wouldn't need a PhD for that."

It was stunning news. He wasn't going to get a scholarship after all. Even worse, men he regarded as scientific gods had rejected him without ever having known him. Hurt and humiliated, the young man had to fight back the tears of disappointment. He got up from his seat and started to leave. But remembering his upbringing turned to the professor and thanked him for trying to help. Then he walked out the door.

A Challenge—A Chance

It hurt at first. He really hated to face his classmates and have to tell them he wasn't going to get *any* scholarship let alone one of the best. It wasn't pleasant, but somehow he survived. Dr. Blanchard had arranged for Julian to have an interview with an official from Fisk University. The two men met and a short time later the young graduate accepted a teaching appointment at that black institution in Nashville, Tennessee. Interestingly enough at Fisk, at one of those schools where you "don't need a PhD," Julian encountered what he regarded as the greatest challenge of his young life. In his class, he found good students, curious students who were eager to learn. Happily, Julian found himself pressed to stay ahead of them. The young instructor soon decided that to do the best job of teaching he would have to learn more. That meant that somehow he would have to return to school.

Two years after his teaching appointment at Fisk, the young professor was awarded an opportunity to return to school for further study. He received an Austin Fellowship to do graduate work at Harvard. There he plunged into his studies in his usual fashion. Earning straight A's, Julian won his master's degree in one year.

Better prepared, the young chemist eventually returned to teaching at a black institution. At first he went to West Virginia State College, where he was a one-man chemistry department. Later, he went to the larger and better known black institution, Howard University in Washington, D. C. He was not there long before another opportunity for further study presented itself in the form of financial aid from a wealthy former classmate and a grant from the General Education Board.

With this support an inspired Percy Julian went abroad to Vienna to work toward the doctorate. There for two years he worked under the highly respected chemist, Ernest Späth at the University of Vienna. In 1931 he was awarded the PhD degree in organic chemistry.

Physostigmine

While Julian was a graduate student in Vienna, German scientists were importing the leguminous plant called soya bean for intensive study. They were interested in the bean of this plant because it had been discovered to be the source of many chemicals known to be useful to man. One such chemical was physostigmine, a substance doctors prescribed as a medical treatment for the damaging eye disease known as glaucoma. When a person is afflicted with glaucoma, he suffers from great fluid pressure in the eye chamber. If allowed to go untreated, this pressure leads to permanent blindness by destroying the retina. However, there was a drug known to be useful in treating glaucoma. It was called physostigmine. Scientists and doctors had known about physostigmine

and its medical benefits for many years. Oddly enough, though, they did not know *how* the drug worked. In addition, no one knew how to reproduce the substance synthetically. Synthesis, of course, means the putting together of the right chemicals in such a way that they duplicate plant and animal products. This is often very important in chemistry. When substances are produced synthetically (or artificially) in the laboratory, it means that man has unlocked another of nature's intriguing secrets. Also it often means lowering costs so that more people, particularly the poor, may benefit. Beyond that, it sometimes allows man to improve upon nature.

In the field of chemistry, physostigmine may be considered an organic compound so the synthesis of a compound in this class would be called organic synthesis. Percy Julian had become quite knowledgeable and skilled in his field while a student of Dr. Späth. Späth himself had received considerable acclaim for his successes in synthesizing nicotine, which is found in tobacco, and ephedrine, a medicine found useful in treating hay fever, asthma, and other causes of respiratory congestion. His American pupil, Percy Julian, had become interested in attempting the synthesis of physostigmine.

The synthesis of a chemical compound like physostigmine represents a challenging undertaking. The interested researcher must have spent considerable time in developing the laboratory skills needed to conduct high-level scientific research. He needs to know the chemical and physical properties of the natural compound—in this instance, physostigmine. Going further the chemist needs to search the literature to learn the properties of compounds which behave in a way similar to but not precisely like the substance he wishes to synthesize. After these investigations have been carefully made and recorded, the scientist seeks to determine the precursors. Precursors are chemical units that must be discovered and assembled before the compound can be synthesized. After the precursors are known, the chemist must then put them together in an exact order or sequence to get the desired compound. When at last he feels he has obtained the desired product, he must run tests called confirmatory tests to verify his synthesis. This must be done carefully and thoroughly. Only then can the scientist announce that a chemical substance has been synthesized.

February

His graduate work in Vienna completed, Dr. Percy Julian prepared to return to the United States and Howard University. Knowing he would need trained assistants to work with him in his attempts to synthesize physostigmine, the young chemist obtained permission from Howard authorities to bring to America two colleagues who had been doctoral

candidates with him in Europe. Soon after their arrival the team went to work.

It wasn't too long before the efforts of the research team began to show some progress. Unfortunately, just about the time Julian and co-workers began to feel a measure of optimism, a misunderstanding created a rift between him and university authorities. The misunderstanding was regrettable but serious. With the two parties unable to find areas of agreement, Julian resigned from his appointment at the university. With no laboratory and no support, the physostigmine synthesis project came to a grinding halt. Fortunately, all was not lost. For over at DePauw, Dean Blanchard learned of the plight of his former star pupil. "Come to DePauw," he invited Julian. "The work must go on." The dean assured Julian that somehow, somewhere, he would find the money to continue the important research.

Blanchard was as good as his word. The former North Carolina native made Julian a research fellow and organic chemist at DePauw. He arranged for Julian to bring one of his assistants, a Dr. Pikel, with him. Then, literally begging support funds from trustees, alumni, and friends, Dean Blanchard obtained the financial base that made continuation of the search for synthetic physostigmine a possibility.

Blanchard's faith paid off. In 1934, two years after he had gone to DePauw, Julian was able to read two scientific papers at a convention of the American Chemical Society where he made the momentous announcement that he and Dr. Pikel had determined the precursors of physostigmine!

That announcement did not go unnoticed. Congratulations came in to Julian and DePauw from American and European scientists. His spirits uplifted, he returned to the laboratory, determined to complete the synthesis. But, unfortunately, a new crisis developed. Officials at DePauw decided to withdraw support from his research efforts.

Understandably, Julian was upset. He simply could not understand why, with success closer than ever before, the university would not continue to show its faith in his efforts and in the obvious promise that a breakthrough was near. For the moment he found it difficult not to be discouraged. Was it true, as some had said, there was no place in this country for a black scientist? This latest setback caused him to ponder the question anew.

Fortunately this crisis of the spirit was not to last too long. Officials of the Rosenwald Fund informed of the physostigmine project's financial difficulties, and recognizing the merits of the research, agreed to fund the project for another two years.

Freed of money worries, Julian pushed the physostigmine research, and it moved ahead. One year later in the laboratory at DePauw, a synthetic substance that appeared to be physostigmine was produced.

Now tests would have to be run. A sense of anticipation began to develop. The substance was analyzed to see if the right chemicals were present. A weight called molecular weight was determined to see if the chemicals were present in the correct amount. A cluster of active chemicals called the functional groups were identified. The researchers had to see how well the chemicals would dissolve in water as they ran solubility tests. Finally, on a wintry night in February, with Dean Blanchard looking on, Julian and Piki ran the last test. All tests turned out to be positive! Success had come at last! For the first time, physostigmine had been synthesized!

A New Career

Encouragingly, more recognitions came in to DePauw and its physostigmine scientists. With the synthesis of physostigmine behind, Dean Blanchard wanted to make Julian chairman of the chemistry department. This move was blocked, however, by the objections of his colleagues. Then the Institute of Paper Chemistry offered Julian a research position with their company, only to withdraw it when they discovered that a municipal statute in Appleton, Wisconsin, the city where the industry was located, prohibited the housing of a Negro overnight. But W. I. O'Brien of the Glidden Company, manufacturers of paints and brushes heard of the strange dilemma and immediately asked the DePauw professor to join his company as Director of Research, Soya Products Division, Vegetable Oil and Food Division, and Manager of Fine Chemicals. Julian accepted that offer, and a new career was launched.

Since much of his work involved the soybean, Julian has often been called the soybean chemist. As such, he had a productive career at Glidden. From this plant, he and his team extracted a relatively inexpensive protein that could be used instead of the more expensive casein from milk. The soybean protein could be used in sizing of paper (that is, filling of pores), waterproofing of cartons, and permitting improved printing. More than that, this extraction process held promise for low-cost protein feeding of large populations of people, especially in underdeveloped countries. Julian also used soybean proteins to produce "Aero Foam," a fire extinguisher. During World War II, Aero Foam was used to save countless American servicemen from injury and death by fire. In still another research project, the soybean chemist found an efficient and economical way to extract a substance called a sterol from the soya bean. With this sterol he was able to mass produce the synthetic sex hormones called progesterone (female) and testosterone (male). These hormones are among several vital chemicals normally secreted by the ductless gland so the body can function normally. There are a number of medical uses for these compounds, including their use as treatment for cancer, for certain pregnancy disorders, certain menstrual disorders, and to balance the body hormones. But before their synthesis, they could be

marketed only in small amounts and at high costs.

Although these are all solid achievements in science from which mankind has benefited, Percy Julian is best known for his work in synthesizing the drug cortisone.

Cortisone, widely heralded as a wonder drug, is used to bring relief to those who suffer from the painful and crippling disease, arthritis. The medical benefits of this drug were first announced by researchers of the famed Mayo Clinic. At that time, the best known source of cortisone was bile. The trouble was that it required huge quantities of bile from oxen to produce only a small trickle of cortisone. That meant only a few arthritis victims could be treated by the small supply of available cortisone. It also meant that the cost of the medical drug was so very high that fewer still could afford it. But with the successful production of synthetic cortisone by Julian and his team at the Glidden Laboratories, the cost of cortisone dropped from several hundred dollars to only a few pennies per treatment. Moreover, the substance could be produced in such large quantities that millions could now be treated. The synthesis of cortisone was indeed a remarkable and welcomed scientific feat.

Julian was to work at Glidden for some eighteen years. In 1954 he left that company and became founder-president of Julian Laboratories, Inc., in the Chicago area and opened the Laboratorios Julian de Mexico, S.A., in Mexico City, Mexico. In that Central American country it had been discovered that there was a wild yam plant that could provide a greater yield of the raw materials used to produce synthetic cortisone than the soybean plant. This business-scientific venture continued for ten years up to 1964 when Julian retired and sold his laboratories for a handsome profit. Still his scientific work continues as he serves as director of Julian Research Institute in Franklin Park, Illinois. During his long and productive career, he has published some two hundred papers in respected journals and has more than one hundred patents to his credit.

Standing Fast!

Dr. Percy Julian is a scientist and a businessman. On the other hand he is also a family man. He and his wife (who also holds the PhD degree) are the parents of two children, a son and a daughter. He is a man of polished manners, and his speech and writings reveal him to be well versed in the use of words. But he is also a strong-willed man and a person of admirable courage. He has had to demonstrate that courage many times as the problems and setbacks he has encountered would have discouraged many and embittered the rest. He and sometimes his family with him have had to endure embarrassments, violence, and the hanging threats of violence.

Once, not long after the successful synthesis of cortisone, Julian bought a comfortable home in an all-white Chicago suburb. Vandals attempted to burn the house before he could move in, but they were

frustrated by alert neighbors. After he moved in, terrorists tossed a bomb from a speeding car. It exploded near the rooms of his sleeping children. Fortunately, no one was injured.

Though newspapers and several residents expressed outrage over these attacks, a number of Julian's friends expressed concern for his safety. Julian patiently explained that he was merely exercising his right as an American to purchase, and live in, a home where his family could be comfortable and in a neighborhood where his children could obtain a quality education. Nevertheless, the threat of further violence was real. For that reason, the Julian residence was under constant guard for one year. In time, however, the Julians became prominent citizens in their community.

There were other episodes in Julian's life that tested his forbearance. Once he was extended an invitation to attend a meeting of a national scientific society—the invitation coming in recognition of his research productivity. But only a short time before he was to appear, officials asked him not to come. They made clear that his scientific credentials were unquestioned. However, the establishment where the meeting was to be held, a place of welcome to both white Americans and foreigners, had historically been set off limits for blacks as guests. An outspoken Julian pointed out that there was little difference in his exclusion from the scientific community and those who sought to bar him from his chosen community by bombing his home.

Dreamers and Fools

Percy Julian has often pondered the waste of talents to the ghetto. He believes that area of racial blight denies the nourishing and developing of scientific talent. In terms of scientific development, he said that the ghetto was about as "nourishing as a desert." "Ghetto poverty," he once wrote, "was so devastating that it required a dreamer and almost a fool . . . but, there were a few dreamers or fools who dared to follow their urge toward pure science."

For those "dreamers" and "fools" who somehow clawed their way through the ghetto, sometimes through loneliness, sometimes scorn, and there met the unique demands for success made on them by the larger society, there were often special problems. Julian noted that the black scientist frequently found it difficult to retreat to the "seclusion of the laboratory where he might throw himself into some all-absorbing problem." He would no sooner do this than society would demand that he show himself or serve on some civic committee; or take some other course of action against some person or conditions that were oppressive to his people. Moreover, until recently, there was little or no incentive for the black man to venture into science against such hardships. Until recently, outstanding colleges and universities would not hire him, few

industries would touch him, and even some public libraries closed their doors to him. But almost equally as frustrating to Julian was the fact that when some black scientist displayed some above-average talent or accomplishment, all too often the praise proved out of proportion to the deed. It happened to Julian, and this is what he said about it.

Indeed, when I was made "Chicagoan of the Year" by the generous gesture of the Chicago *Sun-Times* and Junior Chamber of Commerce, I had begun to feel a bit weary of "over-exaltation." One of the few times in my life, I perhaps seemed ungrateful and ill-mannered, as I opened my acceptance speech with "Friends, I appreciate deeply all this outpouring of good will, but I don't know why you should so honor me, except I belong to a race which hangs heavily on your conscience."

But the soybean chemist, who has seen so much and continues to contribute, magnificently, is not discouraged. For in his eyes, things are getting better for the black scientist, at least in terms of the opportunities opened up to him. New positions at heretofore unheard-of levels in industry, in government, and in the universities are opening to him. The problems of the ghetto are not yet solved, but more black scientists are emerging. And in the black scientists, Julian sees an unusual blending of humanists-scientists, a combination bred into the black scientist because he has had to cope so deeply with human problems all his life. He is, says Julian, "slowly arriving; he has faith in himself, and he comes with his imaginative powers broadened and strengthened and he is laying valid grounds for intellectual self respect."

If it does happen, no small credit must be given the black pioneer scientist, Percy Julian. His modesty would lead him to deny it, but he is a giant and a first among equals of such pioneers.

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GRANVILLE T. WOODS



Railway Communications
Wizard 1856-1910

W. Sherman Jackson

THE inventions of Granville T. Woods helped to revolutionize transportation and communication in America during the last two decades of the nineteenth century. Before his death in 1910 Woods had invented various electrical instruments which had a notable impact on the growth and development of such companies as Westinghouse Air Brake Company, General Electric Company, American Bell Telephone Company, and American Engineering Company of New York. To appreciate the contributions of Woods in the transportation and communication industries, we must consider some of the obstacles he overcame.

Woods was born on April 23, 1856 at Columbus, Ohio. Because the Northwest Ordinance of 1787 had prohibited slavery in the territory from which Ohio became a state, Woods was born a free black. Still, there existed as much hatred and racist thought, if not more, toward blacks in Ohio as in any state, north or south. In 1804 and 1807 Ohio became the

first state north of slavery to adopt the notorious "Black Laws" which "regulated black and mulatto persons" in that state. In subsequent years Ohio adopted other "Black Laws" which prohibited the entrance of blacks into the state unless a bond of \$500 was posted; deferred blacks from serving in the militia; prohibited the erection of schools for black children; and prohibited blacks as witnesses against whites regardless of the circumstances.

Since very little is known about Woods' parents, it is difficult to establish whether they were native Ohioans or migrated there from either Virginia or Kentucky which bordered Ohio's southern and eastern boundaries. Woods was five years old when the Civil War erupted between North and South and nine years old when it ended in 1865.

The next seven years were uneventful for Woods. One can only surmise that during these years he engaged in the average activities which were typical of a teenager in a midwestern state: hunting, fishing, and exploring the wilderness. Woods attended school, because Ohio modified its earlier prohibition on education for blacks. At the age of sixteen he decided to leave Ohio and traveled to Missouri where he labored for the railroad as a fireman. His experiences with the railroad helped to stimulate his interest in electricity. For the most part Woods was a self-educated man. He used his leisure time to study electricity in books which he borrowed. Some of these books were individually owned and others came from the public library. After working several years on the railroad, Woods traveled east and secured employment as a machinist and attended night classes in electronics for two years.

Telegraphy and Electric Trains

At the age of twenty-three Woods went to sea as an engineer aboard the British steamer, *Ironsides*. For several years he sailed from continent to continent and eventually traveled around the world. From his travels he learned much, but he longed to return to the railroad. In 1880 he was hired as an engineer for a Cincinnati-based railroad company. After four years of work as a thermal power (steam heat) engineer, Woods decided to open an electric company. In 1884 he founded the Woods Electric Company of Cincinnati. Woods' company was one of the few owned and operated by a black in Cincinnati at this time; 1884 was also the year that he invented a telephone transmitter. This pioneering device soon terminated the need for persons who knew the Morse code system. Woods called his invention "telegraphy" because it could be used for oral and signal messages.

Demands for the telegraphy became so great that Woods decided to sell out to a larger firm, American Bell Telephone Company. The substantial amount paid to Woods for his invention enabled him to close his company and devote the rest of his life to inventing. Shortly thereafter he

invented the rail telegraphy which could send messages between moving trains and to rail stations. This invention helped rail operators determine the location of different trains, thereby preventing many accidents. Before Woods' invention there had been many serious train accidents. His rail telegraphy helped to minimize locomotive mishaps.

In 1888 Woods invented a device which powered trains by electricity instead of steam heat. Because electricity was more efficient, inexpensive, and cleaner, many railroad companies switched to using this invention.

Granville Woods moved to New York in 1890 where he and his brother, Lyates Woods, continued to work on various electrical projects. When he died in 1910, Woods had recorded more than sixty patents with the United States Patent Office.

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CHARLES RICHARD DREW



Blood Plasma Pioneer 1904-1950

Gossie Harold Hudson

SOME say that Charles R. Drew died prematurely because his death resulted from an automobile accident near Burlington, North Carolina, when he was only 45 years old. Yet, he had lived a full life. Saving countless lives of servicemen in World War II, his experiments on preserving blood plasma became the foundation for two blood banks. Dr. Drew introduced the use of plasma during World War II; he also organized the world's first mass blood project, for Great Britain, and established the American Red Cross Blood Bank of which he was the director. Because of his pioneering efforts in medical science, the world opened its eyes to a longer expectation of life.

The earliest known black physician was Imhotep. He established schools of medicine and defined therapeutic principles in Egypt, probably about 3,000 B.C. In colonial times Lucas Santomé of New York studied medicine in Holland. He practiced under both the Dutch and the English,

and received a grant of land for his services to the colony in 1667. James Derham, the first regularly recognized black physician was born in New Orleans about 1760. He acquired his medical knowledge from three doctors who were his successive owners: Dr. John Kearsley, Dr. George West, and Dr. Robert Dove. Dr. James McCune Smith, the first black MD to practice in New York, received his degree at the University of Glasgow in Scotland in 1837. Ten years later, David J. Peck received a degree from Meharry Medical College in Tennessee.

In 1849 Bowdoin College in Maine conferred MD degrees on John V. De Grasse and Thomas J. White. The 1890s saw the graduation of the first black woman physician: Susan McKinney. The manchild Charles Drew, destined to achieve fame as a brilliant scientist, famous surgeon, and legendary teacher, was born twelve years after Dr. McKinney began practice in New York City in 1892.

"Best Athlete"

Charles Richard Drew was born June 3, 1904, in Washington, D. C., the eldest of five children. His parents never dreamed that their son would become a famous surgeon. In fact, Richard T. Drew, a carpet layer, and Nora Burrell Drew, a school teacher and graduate from Miner Teachers College, saw very little indication during his school career that their junior high school newsboy would ever deserve the title "Father of the Blood Bank." But he was an excellent student and a gifted athlete. In high school he was tagged as the "best athlete," "most popular," and the student who had done the most for his school. Whether in Stevens Elementary School, where he graduated in 1918, winning four swimming medals at the age of eight, or the District's Paul Laurence Dunbar High School from which he graduated in 1922, he led his teams in sports, including football, basketball, baseball, and track.

After graduation from Dunbar he attended Amherst College in Massachusetts on an athletic scholarship and won the Thomas W. Ashley Memorial Trophy as Amherst's best all-round athlete. Amherst also bestowed on him the Pentathlon Award for excellence in five sports and the Mossman Trophy as the man "who contributed most to athletics." Drew's athletic career was relatively long, extending over 19 years. During these years he received numerous awards including the Canadian Championship in hurdles, high jump, and broad jump.

In 1926, Drew graduated from Amherst with highest honors and accepted two responsibilities at Morgan State College in Baltimore, Maryland: He was professor of both chemistry and biology and he served as director of athletics. Under his tutelage, the Morgan Bears won national honors. But while at Morgan, Drew dreamed of "other worlds to conquer." One of his biographers wrote that: "Charles said to himself, 'I'm going to see how this body works.'"

A Rosenwald Fellowship

Two years later, he applied to the Howard University School of Medicine, but was rejected because of technical insufficiency points. He immediately applied to another college and entered McGill University Medical School in 1928. McGill University was known for being an outstanding university and for accepting black students. There he continued to excel both in scholarship and sports. His success in sports helped him to obtain a referee position which provided him with a source of income. His abilities in science won for him membership in the school's medical honorary society. At McGill, Charles met Dr. John Beattie, assistant professor of anatomy, who not only taught Drew bacteriology but encouraged him to continue his career in medical science. During his senior year at McGill the dean called him into the office to compete for a prize in medicine. He was one of 5 in his class of 137 selected to take an examination for the award. Charles scored the highest grade and won a \$1,000 Julius Rosenwald Fellowship for further study.

After graduating in 1933, receiving his MD and Master of Surgery degrees, Drew interned for a year at the Royal Victoria Hospital and a year at Montreal General Hospital as a resident in medicine. He continued his research on blood and completed his residency in surgery in 1935.

Blood Research

Drew left Montreal rather unfulfilled because his real interest and skill lay in surgery. However, his great interest in teaching young people brought him to Howard University where he had been invited to teach pathology. The following year, he obtained a residency in surgery at Freedmen's Hospital, a federally operated facility associated with Howard. In 1938, Drew accepted a two-year Rockefeller fellowship in surgery at the Presbyterian Hospital in New York City and a General Education Board Fellow in Surgery at Columbia University. There he worked on blood research with Dr. John Scudder and Dr. E. H. L. Corwin in the department of surgery. There, too, he developed a process whereby blood plasma could be processed and preserved. It could be shipped to distant places and used for transfusions in saving lives. With a dissertation on the subject of "Banked Blood: A Study in Blood Preservation," he earned the degree of Doctor of Science in Medicine at Columbia University in 1940. Earlier he had learned of "banked blood" from Dr. Bernard Fantus, who had directed a blood bank in Chicago under the auspices of Cook County Hospital in 1937.

With the aid of a leave granted by the Presbyterian Hospital, Drew set up his blood plasma system in 1938. A blood bank set up at the Columbia Medical Center under his supervision in 1939 resulted in his

discovering that blood plasma could replace whole blood, which deteriorated in a few days in storage, in transfusions.

Blood Banks

Early in World War II, England suffered terrible casualties from the air blitz. The country desperately needed blood. It came as no surprise when the Royal Air Force asked for and received 5,000 liters of blood from the Presbyterian Hospital. The plasma system worked so well that the British set up a program to get banked blood from America.

Drew's former instructor and friend, John Beattie, who had become director of the Army Blood Transfusion Service in England, suggested to his English colleagues that Drew was well qualified to direct the project. Upon approval by the group, Dr. Beattie cabled the following:

Could you secure five thousand ampoules dried plasma for transfusion work immediately and follow this by equal quantity in three to four weeks. Contents each ampoule or u should represent about one pint whole plasma. — BEATTIE

To this request Drew replied: "There are not five thousand ampoules of dried plasma in the world but assistance will be forthcoming." Later, the Blood Transfusion Association commented: "Since Drew who is a recognized authority on the subject of blood preservation and blood substitutes and, at the same time, an excellent organizer, has been in charge, our major troubles have vanished."

Howard University released Drew from his instructional duties in order for him to return to New York at the request of the New York Academy of Medicine's Blood Transfusion Association. The medical board unanimously chose Drew as medical supervisor of the plasma project for England. His success in Europe led to an appointment with the American Red Cross Donor Service. This resulted in a blood procurement program under the auspices of the Surgeons General of the Army and Navy after which Drew was named director of the first Red Cross project to collect and bank the blood of 100,000 donors.

Ironically, Dr. Drew achieved a pioneer role as administrator at the head of an organization which was directed, for a period, not to accept the donations of black volunteers. In 1941, the War Department sent out a directive stating that:

For reasons not biologically convincing but which are commonly recognized as psychologically important in America, it is not deemed advisable to collect and mix Caucasian and Negro blood indiscriminantly for later administration to members of the military forces.

The issue caused a widespread controversy and protests came from Congressman Arthur W. Mitchell of Illinois and others. Drew called the order, which gave the impression that white and black blood were different, a "stupid blunder." When the Japanese bombed Pearl Harbor, December 7, 1941, 150 pints of plasma were flown to Hawaii. The shipment saved hundreds of lives. However, Drew, the scientist who had

made it possible, was asked to resign because of his stand on racial segregation of blood.

Drew returned to his studies at Howard University and Freedmen's Hospital. Calling a press conference, he said that "The disservice has been done not only to the Negro people but to the cause of truth itself." He asked, "How have we, in this age and in this hour, allowed once again to creep into our hearts the dark myths and wretched superstitions of the past?" Commenting on universal brotherhood he pointed out that "In the laboratory I have found that you and I share a common blood; but will we ever, ever share a common brotherhood? As repugnant as this scientific fact may appear to some," he went on, "their quarrel is not with [man] but with the Giver of Life whose wisdom made it so."

A few months after his return to Washington, the order was rescinded. Later, he admonished: "I have been asked my opinion of the practice of separating blood of Caucasian and Negro donors. My opinion is not important. The fact is that test by race does not stand up in the laboratory."

At the Howard School of Medicine and Freedmen's Hospital, Drew returned to his first love and primary interest. Because of his outstanding ability and skill, the school soon elevated him to full professorship, head of the department of surgery. He was also a Diplomate in the American Board of Surgery and became an examiner in 1942, a position never before held by a black person.

Battles for Equality

During the 1940s Drew received scores of awards and honors. In 1944 he received the coveted annual Spingarn Medal from the National Association for the Advancement of Colored People "for the highest and noblest achievement by an American Negro." He received the honorary degree of Doctor of Science from Virginia State College in 1945. The International College of Surgeons, 1946, elected him Fellow. Again, in 1947, he traveled to Amherst College to receive an honorary Doctor of Science degree; and in 1949 the Armed Forces awarded him the title of "surgical consultant." As a member of a team of four physicians, he toured hospital installations in occupied areas of Europe. The military, by this time, no longer insisted that its white soldiers receive only blood from white donors.

Yet despite national as well as international fame, Drew never lost the common touch; no task was too menial as he was in constant demand as a speaker for both lay and professional groups. He gave free counsel and service to local communities and to small hospitals. Moreover, he made numerous trips to many cities to make certain that doors would be open to black surgeons. Indeed, because he fought tirelessly for equality and fair play in the practice of medicine and training of doctors he caused many barriers to be lowered.

Despite racism, Drew continued to believe in the higher calling of world humanity. His own words epitomized his philosophy, a philosophy which no doubt, helped him to survive during those dark days in the early forties when he was forced to resign from his blood plasma project. "There must always be the continuing struggle to make the increasing knowledge of the world bear some fruit in increasing understanding and in the production of human happiness." On another occasion he concluded: "The blood of individual human beings may differ by blood groupings, but there is absolutely no scientific basis to indicate any differences according to race."

These words spoken many years ago probably had even greater meaning after his time, certainly by the 1970s.

Up until his death, Drew wrote articles on hematology (study of blood) for medical journals; and scientists internationally recognized him as one of the world's leading hematologists.

On March 31, 1950, Dr. Charles Drew overturned in an automobile accident near Burlington, North Carolina and was killed. He and three of his colleagues from Freedmen's Hospital had been on their way to a medical meeting celebrating the Annual Founder's Day of Tuskegee Institute in Alabama.

On Monday noon, April 3, 1950 "Charlie's" friends called a meeting. The nineteen friends who met in the office of the medical director of Freedmen's Hospital decided to incorporate in the District of Columbia the Charles R. Drew Memorial Fund. His colleagues also proposed that they further the work of Dr. Drew by continuing existing projects and by establishing scholarships and lectures in his name. Elsewhere telegrams from individuals, institutions, and patients nationwide attested to Drew's invaluable contributions, not only to medical science but to humanity as well. Undoubtedly, as a pioneer blood plasma researcher he earned the gratitude of all humanity by saving countless lives during and after World War II. A recent biographer says, "Dramatic and deeply moving, his story is one of indomitable courage, inspiring self-sacrifice and true human greatness."

Another writer informs us that "Dr. Drew is an excellent example of a great American who did not work for financial gain for himself, but for the betterment of his fellowman."

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CHARLES HENRY TURNER



Scientist, Teacher, Author,
Humanitarian 1861-1923

Gossie Harold Hudson

ONE by one they moved in and out of their tiny holes. Moving with precision and exactness, they cavorted about, leaving their immediate surroundings, never getting lost, and always returning to the same ant hole.

Charles Henry Turner, eyes fixed only a few inches from the ground, his stomach pressed against the earth, gazed intently at the ants moving in and out of their natural habitat. Finally, he exclaimed: "How mysterious this is!" The creatures possessing a high sense of direction, seemed almost human, he thought. "Voilà! I've got it!" he said. Sometime later he wrote an article for the *Biological Bulletin*, "A Preliminary Note on Ant Behavior." Turner's lifetime searching for answers to numerous questions about insects and animal behavior led him to become one of the great scientists of the twentieth century as he made impressive discoveries about behavior of bees, moths, ants, cockroaches, and other insects.

As a young boy, the lad had prodded his teacher with prying questions about nature and small animals. Why do animals act as they do? What makes insects fly? Can the honey bee distinguish colors? Can the honey bee distinguish between patterns? Can a cockroach learn? Can insects hear? Do ants form practical judgment? The answers are found in the more than fifty articles published in the leading journals of his time: *Biological Bulletin*, *The Journal of Comparative Neurology*, *The Journal of Animal Behavior*, and the *Psychological Bulletin*. The quantity and the quality of Turner's scientific research, accomplished despite the odds against him, is amazing even to the novice.

Science as a discipline is universal, but black Americans have always contributed immensely to all phases of the American civilization, not the least of which is science. Preceding Turner, some of the notables in the field of science were Benjamin Banneker, who calculated solar eclipses and the cycle of the 17-year locust; Lucas Santomé of New York, who was trained in medicine in Holland and practiced under the Dutch and the British; and James Derham, who became the first black doctor, practicing in New Orleans in the 1780s. In the area of pure scientific research, Edward Bouchet was the first to receive a PhD degree from an American university. He received a PhD in physics from Yale University in 1876. Thus the genius of black scientists is indelibly inscribed in the great saga of American science. And the significant contributions of black scientists are one of the most inspiring chapters in the neglected history of Afro-Americans.

Charles Turner was born February 3, 1861 in Cincinnati, Ohio. His parents, Thomas and Addie Campbell, were born in Alberta, Canada, and Lexington, Kentucky, respectively. The father of the boy, a church custodian, acquired a large home library of several hundred books which probably whetted his son's early thirst for knowledge. He constantly provoked his teacher with piercing questions about the mysteries of life. Presumably, his mother, a practical nurse, encouraged the boy's natural bent toward science. By the time young Turner was graduated from elementary and high school, he had already decided what he wanted to do in life. He completed a college course at the University of Cincinnati in 1891 and obtained the degree of Master of Science there the following year. Before graduating, Turner taught for a short while in Governor Street School of Evansville, Indiana, and substituted in the grammar schools of Cincinnati. During the year 1892-1893, he served as assistant in biology at the University of Cincinnati.

Committed to helping his own people, however, he wrote to Professor Booker T. Washington, head of Tuskegee Institute in Alabama. "I am a colored man and at present am teaching in the University of Cincinnati. I am anxious to get to work among my own people. I would like to obtain a position as Professor of Natural History. . . ." Subsequently, from

1893-1905, Turner was in charge of the Science Department and professor of Biology at Clark College in Atlanta, Georgia. Clark was founded in 1869 by the Freedmen's Aid Society of the Methodist Episcopal Church to elevate black people through education.

Unfortunately, in 1895, Mrs. Leontine Troy Turner, wife of Professor Turner and mother of their five children, died in Atlanta. A second wife survived Turner and died in Chicago in 1946. Three of their children survived Leontine's death: Mae (Mrs. William T. Spencer), teacher; Owen and Darwin R. Turner, registered pharmacists and owners of a pharmacy in Chicago. Today, his grandson, Dr. Darwin Troy Turner is Director of the Institute for Afro-American Culture at the University of Iowa, Iowa City.

Charles Turner was not a man seeking degrees. He was a scientist, as one writer points out, who found his greatest pleasure in the midst of bees, ants, and wasps.

Experiments with Insects

His strength lay in his analytic ability and his techniques of experimenting. For instance, he discovered by ingenious experiments that ants are not guided home by odors but by light rays. With the help of his window shades he used the same technique to prove that wasps find their way home by landmarks and not by some sixth sense or instinct. In his work on the homing of the burrowing bees, Turner found that any change in topography is sure to confuse the insect upon its return home. From this he concluded that bees find their way home by great reliance on memory pictures.

His investigations on tropisms (involuntary movements of an organism, to a stimulus) demonstrated that certain invertebrates exhibit a "turning" activity upon sensory excitation. Examples: The blowfly larva turns and creeps away from light. Also when one enters a dark cellar at night and turns on the electric light, his eye will detect roaches rushing in all directions to the cracks and crannies. "Undoubtedly," Turner suggested, "they are rushing away from light." Always the scientist, he concluded that "the term tropism can be so defined as to make it an easily recognized type of behavior, and that nothing can be called a tropism that does not stand the test of critical experimental analysis." Later the animal behavior literature of France adopted the name "Turner's Circling" to describe certain characteristic ant movement.

Between 1894 and 1897, Turner attended the University of Chicago. However, he continued to teach at Clark College until 1905. He was principal of a high school in Cleveland, Tennessee, until 1906. Turner achieved one of the highest of all academic honors in 1907 when the University of Chicago conferred upon him the degree of Doctor of

Philosophy, *magna cum laude*. Yet he never held a teaching position in any large American university with adequate research facilities.

He carried on his research with meager equipment and facilities. Nevertheless, he conducted observations and experiments on spiders, crayfish, ants, and other invertebrates. Most of his work was done alone and unaided.

Additionally, the limitations imposed by a measly salary compelled him to purchase his own tools, specimens, and library for research. In later years, his daughter recalled, "We had to live with voluminous books and laboratory specimens of ants, bees, roaches, snakes, and other creatures. But, to me," she continued, "my father was just a plain, kind man who instilled in us those qualities that would make for the simple successful life." From 1907 to 1908 Turner taught biology at Haines Normal School. The following year he began a long career of teaching biology and psychology at Sumner High School in St. Louis. The starting salary was \$1,080 per year.

As a teacher he was knowledgeable, perceptive, innovative, energetic, and completely dedicated. He utilized the microscope and classified his lectures by using colored chalk to draw illustrations on the board, using both hands at the same time. Often he took his class on field trips to observe and experiment with science and to develop curiosity about nature and a reverence for life. Some say that Charles Turner knew the language of the birds; he seemed to translate the "coos" of pigeons' talk into expressions of love and family life. A scientist-researcher, he brought a wealth of first-hand information to class.

Writing

Still, the teacher-scientist found time to write. He published five papers in 1911; seven in 1912; three in 1913; four in 1914; three in 1915; two in 1916; one each in 1917, 1918, 1921, 1922, and four in 1923. In his publication of 1923, "A Week with a Mining Experiment," he explained how the watercarrying mining wasp paralyzes caterpillars for her young; how she attaches her eggs to the thread; how she is guided to and from her nest by visual landmarks; and the difficulty the wasps have in returning home.

One of the more provoking questions that plagued Turner was whether insects can or cannot distinguish colors. He solved the problem in 1910 by the ingenious method of contriving tests with certain colored disks of paper and certain colored boxes which were filled with honey. His findings were that odors alone do not lead bees to flowers, but that bees do respond to colors and are capable of recognizing them at a distance.

Turner's work sometimes involved only observation. He would sit in awe for hours gazing at funny-shaped animals, taking especial notice of the pit-making ant lion, his favorite insect. One day while observing the

ant lions, he saw a perfect example of death feinting. He also discovered that the ant lion has not one, but several death attitudes; likewise, it possesses a number of death feigning postures, some of which resemble death poses and some of which do not. Considering the cunning, deceptive tricks played by house cats, Brahmin bulls, foxes, and opossums, Turner contended that suddenly playing dead was the insect's way of reacting when startled. "The ant lion lies motionless for prolonged periods of time," Turner thought. "I am fully convinced," he observed, as he pondered the results of his experiments, "that it really is no feigning of death at all and required no self-command. It is simply terror paralysis which has been so useful as to become hereditary."

One writer said that, "Nature lovers and scientists cannot but feel grateful for Dr. Turner's admirable contributions." Yet, in a larger sense, Turner was not only a scientist and academician, but a sort of novelist-poet, for his relatives found several chapters of a novel among his unfinished papers. With such a busy teaching and writing schedule, it appears unbelievable that he found the time to write a book on nature studies for children and a book of thirty-two poems.

Turner, the Man

Fortunately for unemployed St. Louis blacks, Turner not only worked for the civil rights and the betterment of life for his people, but he pioneered in developing social work. Indeed, his interests were not solely scientific; he identified with his people in thought and in deed. Oftentimes, his time and strength were severely taxed by his faithful devotion to various sociological works in the black community. When he died in Chicago, February 14, 1923, the Americans, alas the world, lost a scientist, but the black community lost one of its most efficient workers for racial harmony. In a universal sense, however, he left behind an enviable legacy for all people: strength of character, devotion to work, faithfulness to ideals, respect for truth, a keen sense of humanity, and an unselfishness in sharing that which he possessed. No wonder A. G. Pohlman in a memorial speech at Sumner High School, May 25, 1923, concluded by saying: "Permit me, in the name of the Academy of Science [of St. Louis] to pay our respect not only to Turner the scientist, but also to Turner the man." Certainly he was a humble man who might well be taken into the fold of the most highly esteemed.

The life of Charles Turner might have been like that of many other men of his time who pursued their interests in science. It was a little more, however, because finding a job was a serious problem for any Afro-American who obtained an advanced degree in science. Not only that, Turner's field was animal behavior with a specialization in insect behavior. During his era, animal behavior was not the active science it is today. Consequently, there were few jobs available for animal scientists. Accord-

ingly, Turner suffered from the double jeopardy of color and a college degree in an unpopular field.

Nevertheless, he did not allow his lack of teaching affiliation with a university to keep him from being active in his chosen vocation. Though discouraged and frustrated at times, he achieved prominence despite the handicaps. Pohlman, in his appreciation, summed up the situation well when he informed the students and faculty of Sumner High School that no man is great unless he rises above the petty inconveniences of his surroundings; no man is strong unless he meets the competition about him. "It is for you who knew Dr. Turner to satisfy yourself that here indeed was a great man." The *St. Louis Argus* concluded in a tribute that "Dr. Turner was easily the greatest scientist his race ever produced and, in fact, stood in the front rank of the scientists of the world."

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MATTHEW A. HENSON



Famous Explorer 1866-1955

Gossie Harold Hudson

ON APRIL 6, 1909, Matthew Alexander Henson, the first man to reach the North Pole, planted the American flag atop the world as Admiral Robert Edwin Peary saluted. Two years later Peary recalled that: "On that bitter brilliant day . . . when the stars and stripes floated at the North Pole, Caucasian, Ethiopian, and Mongolian stood side by side at the apex of the earth, in the harmonious companionship resulting from hard work, exposure, danger, and a common object." Indeed man's quest for the North Pole was over.

Matt Henson was not the first black man who explored and opened up the Western Continent. There is speculation that black explorers and traders may have crossed the Atlantic before Columbus. On the eve of the annual observance of Columbus Day, October 12, 1970, a Los Angeles historian-turned-lawyer, Legrand Clegg II said that some of the best evidence in support of the black explorers theory comes from Colum-

bus' own records. For example, a 1930 British translation of Columbus' writings indicated that Arawak Indians (native Americans) in Haiti told Columbus of black traders from the South and Southeast with spear points made of guanin.¹ Nearly all of the early Spanish explorers were accompanied by blacks. Balboa brought 30 blacks with him, and 300 slaves came with Cortez. As early as 1526, the Spanish explorer, Lucas Vasquez de Ayllon, brought 100 slaves to Virginia and landed near the Pee Dee River in what is now South Carolina. Estevanico, a black man, explored the Florida and the Mississippi region in 1527, and as a companion of Cabeza de Vaca he traveled across Texas and Mexico to the Gulf of California, finally returning to Mexico City in 1536. Nearly four centuries later Matthew Henson continued in the tradition of some of his black forefathers who were among the first settlers in the New World.

Henson was born on August 8, 1866, three years after the Emancipation Proclamation. His birthplace was a farm, the site of a former slave market, in Nanjemay, Charles County, Maryland. His parents, Lemuel and Caroline Henson, both died while Matt was a young child. Except that he was orphaned and ran away from an unkind stepmother, little is known of his early boyhood.

High Adventure Stories

Around the age of 11 Matt walked in the cold winter without shoes to Washington, D. C. There he divided his time between Mrs. Janey's Lunch Room and the N Street Elementary School, which he attended irregularly. During these months young Henson heard many stories of high adventure told by some of "Aunt" Janey's sailor customers.

Restless, excited, and eager to become a sailor, Matt walked from Washington to Baltimore when only thirteen and located around the waterfront. There he met a white-haired man named Captain Childs who employed him as a cabin boy on the *Katie Hines*. Captain Childs was immediately impressed with the boy's intelligence and thereafter tutored the lad in reading, writing, mathematics, navigation, and lessons in the Bible. Matt also learned outside the cabin that some people believed that there were two worlds—one black and the other white. This was especially discomfiting to him when on numerous occasions sailors beat him up merely because of the color of his skin.

For the next five years Matt visited the foreign ports of Hong Kong, Russia, Africa, the West Indies, Spain, and Japan. On shore, he worked at some of the only jobs open to black men: bellhop, stevedore, watchman, and the like. When the captain died in 1883, Matt left the ship as an able-bodied seaman.

¹In the work of the late Professor Leo Wiener of Harvard University, guanin was said to be a gold alloy made in West Africa. (*Durham Morning Herald*, October 12, 1970, p. 7A)

"My Name Is Peary."

Still a young man, Matt returned to Washington and obtained a job as a porter at Steinnetz and Sons, Hatters and Furriers. Here, in 1887, he met Lt. Robert E. Peary, who had observed Matt at work and become impressed with him. "My name is Peary," he introduced himself, "I need a valet to go with me to Central America." "What are you going to do in Central America?" the young man asked (not really interested in manual labor). Peary explained that he was preparing to leave on a survey job for a proposed canal across Nicaragua. Matt, by now an experienced sailor, could well appreciate the importance of a canal to join the Atlantic and Pacific oceans. Besides, this provided him with the opportunity to realize a boyhood dream. Little wonder that he responded, "I shall be honored to join you, sir."

Peary completed the mission in the summer of 1888 and returned to a Navy desk job in July. Henson's future, however, was uncertain. He had seven months of unspent pay in his pocket, but no job. But one day Peary sent for Henson: "Matt, you did a good job in Nicaragua," he said. "Thank you sir," Matt retorted. Peary was stretched out on his back studying the ceiling. Finally, he broke the silence: "No man has come within 600 miles of the North Pole. That land must be explored and claimed by an American. I am going to do it. Somehow, I'll do it." At this time an expedition in search of the North Pole was the intensive objective of many nations.

Peary turned and looked at Henson: "Matt, I am going to try to organize an expedition to explore North Greenland. Do you want to go along? Before you answer," Peary continued, "the North may be hard for you. It will be different for all of us, but perhaps especially for you." Henson's reply was immediate and unflinching: "I'll go, sir. I'll stand it as well as any man." It was a matter of pride and race with Henson. Peary had already informed Henson that there would be money for only subsistence and transportation.

Henson accompanied Peary on seven expeditions into the Arctic and Polar regions that marked 19 weary years of fighting the terrors of the frozen region. Between expeditions Peary lectured widely while Henson became consultant to the American Museum of Natural History in New York on Arctic geography. Authorities, internationally, acknowledged Henson as one of the leading authorities on the Arctic.

The first expedition began in late July 1891 in an old sealer called *Kite*. Peary announced to Matt at the end of that trip, "We're coming back to discover the North Pole." After 1891 a few years of defeat followed, and on one trip Matt became ill and almost died. Returning to the United States, Henson accepted a position in a museum of natural history because of his skill in preparing walrus and musk ox brought back from the expedition. In 1898, Peary and Henson sailed from New York on

Windward. They were determined to conquer the icy, polar region, although they suffered familiar defeats for eight long months. Yet they remained in the Arctic until 1902.

Deciding to see their country again, the men came back to New York where Matt obtained a job with the Pennsylvania Railroad as a porter. Here he worked for three years. Then he heard that Peary was planning a sixth expedition to the Pole. He left for New York immediately. The expedition failed, and the ship *Roosevelt* limped into New York on Christmas Eve, 1906, bearing the dejected, but not discouraged party.

Back in New York, a Mrs. Gardner of Harlem gave a dinner party in Henson's honor. At that party he met and wooed the young and pretty Lucy Ross. It was love at first sight, they said. They visited museums, attended concerts, had walks in the park. He finally mustered up enough courage to say: "Will you marry me, Lucy?" Lucy replied: "Yes Matt, I will marry you," after which Matt promised to bring a wedding gift from the North Pole. They were married in 1907, and Henson went to work again on the *Roosevelt*. The men had spent 18 years acquiring knowledge and skills to conquer the Arctic, and now it was time to realize their greatest ambition.

"Miy Paluk"

Matthew Henson was especially helpful to Peary not only because of Henson's rapport with the Eskimos but because Matt had acquired a good practical knowledge of everything that was a necessary part of the daily life in the ice-bound wilderness. The natives called him "Miy Paluk, dark-faced one." They presumed that he was an Eskimo from some distant tribe because his skin was dark like theirs. Therefore, Matt was a favorite of the Eskimos, from whom he learned the skill of training and driving dogs. In fact, Henson himself built the sleds with which the journey to the Pole was successfully completed. Thoroughly acquainted with the life, customs, and language, in addition to his experience as a navigator, he was an invaluable aide to Peary. In his book *The North Pole*, Peary wrote: "He . . . can handle a sledge [sled] better and is probably a better dog-driver, than any other man living, except some of the best of the Eskimo hunters themselves."

On Top of the World

Peary chose Henson to be a member of a party of six to make the final trek to the Pole, but he selected Henson for his personal companion during the last 173 miles. On a later occasion Commander Donald MacMillan indicated that "Peary chose Matt because he was of more real value than all the rest of us put together."

Commander MacMillan gave the credit and honor to Henson as "the first to place the stars and stripes at the top of the world while the

leader [Commander Robert Peary] sat exhausted on the sledge and feebly waved."

When Peary and Henson were about one hundred and thirty miles from the North Pole, they were left with only four Eskimos, five sleds, and a group of husky dogs. Peary advised Henson to advance forward, make final observations and calculations, and await his arrival. On the last part of the journey, Henson led the way, building igloos at various points along the way. Because of crippled feet, Peary rode in one of the sleds, overcome with frostbite and exhaustion. In the meanwhile it was 25 degrees below zero; cold air seemed to burn their lungs; they began to breathe slowly; and ice coated their beards as they approached their goal. After eighteen hard years and several failures, success seemed within their grasp. Some hours later Matt called a halt; he was standing on top of the world, the first man to achieve it. Approximately forty-five minutes later, Peary arrived on a sled driven by four Eskimos: Ootah, Egingwah, Seegloo, and Ooqueah. Peary's check confirmed the discovery of the North Pole.

Henson and Peary were robbed of the glory, at first, by a charlatan, Dr. Frederick Cook, who falsely claimed to have reached the Pole some months earlier. That claim was eventually discredited, but Peary died soon afterward, and Henson's success was virtually ignored because of racial prejudice. Though immortalized by Eskimos, he was completely neglected, at first, by a color-conscious American public. In fact, Henson saw terrible treatment of other Afro-Americans by racists and on one occasion he, too, was attacked with a shotgun.

Recognition

Six years after the great discovery, Henson was employed in a Brooklyn parking garage, when a black politician, acting independently, secured for the hero a government job in the customs house, as a messenger boy at \$900 a year. Working his way up to clerk at \$2,000 a year, the explorer retired at the age of seventy. During these years four bills were unsuccessfully presented in Congress to award him a pension—in 1926, 1936, 1938, and 1949. At this time even the cook, the boy who fed the dogs, men who never left the warm hut 700 miles from Admiral Byrd's South Pole had received a gold medal from Congress. In 1944 Congress responded to the pressure by honoring all of the Peary expedition with a gold medal. The following year they received the Navy Medal. In 1950, Matt was honored in military ceremonies in the Pentagon and received a salute from President Harry S. Truman. In 1954, President Dwight D. Eisenhower received him in the White House and accompanied him to Arlington Cemetery where they placed a wreath on Peary's grave.

In the black community, Morgan State College and Howard University awarded him the Master of Science degree, while Dillard Uni-

versity in New Orleans named a building for Henson, and Chicago gave his name to a public school. He also received a Congressional Medal, life membership in the Explorers Club, a citation by the U.S. Department of Defense, and a gold medal from the Chicago Geographical Society, inscribed: "I can't get along without him—Peary."

Before his death, Henson, in notes for a lecture tour about his Arctic adventures, stated:

Great ideals are the glory of man alone. No other creature can have them. Only man can get a vision and an inspiration that will lift him above the level of himself and send him forth against all opposition or any great discouragement to do and to dare and to accomplish wonderful things for the world and for humanity. . . .

Matthew Alexander Henson died the next year, March 9, 1955, at the age of eighty-eight.

In 1963, a plaque in Henson's memory was unveiled at the Statehouse, Annapolis, Maryland. After long years of having been completely ignored, Henson was finally recognized by his home state as one of America's major contributors to world geography.

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LEON RODDY



The Spider Man 1921-

Edward S. Jenkins

YOUNG Roddy pulled the large handkerchief from his left back pocket so he could wipe his brow and the back of his neck. His clothes were "wringing wet," and he had difficulty in keeping the salty sweat from running into his eyes. He had paused in his work — taking a short breather. It was hot, and there still remained three hours before his workday came to an end. For a while he tried to forget the heat by thinking about the early morning when it was cooler. It had been just after the dawn when Leon and his father, Floyd Roddy, had come to work in the Amarillo Flour Mills. He remembered approaching the grounds and noticing how the stacks of the mills had stood tall, silhouetted against the dawning Texas sky. Then his father had turned to him and said, "Well Leon, today you go down into the bin."

Floyd Roddy had worked many years in the flour mill, and now he was a foreman there. Leon hadn't exactly wanted to work at the mill, for

he had finished high school and had his heart set on going to Texas College, a Methodist Institution down in Tyler. "I'm sorry, Leon," his father said, "but I sent money to your brother at Wiley College for a whole year only to learn he wasn't even enrolled. No, I'm not wasting any more money on schooling for you and your sister beyond high school. Maybe you'd better come to work at the mill with me. On the other hand, if you are bound and determined to go that school, come to work anyway and earn part of your fee."

That's how young Leon became an employee at the mill. On most days, things weren't too bad. His foreman father had him doing a variety of things, including scooping wheat from the bin to the conveyor belt, unloading boxcars of the grain that came in from Fort Worth. Sometimes he was assigned the job of selling some of the many finished products right out of the warehouse. But at intervals big flour bins had to be cleaned out. Those assigned to work there labored at temperatures that went as high as 140°F, and that alone made the job tough. Leon got angry with his father for sending him down into the bin, but he also knew he could earn more for college there—\$2.50 a day as opposed to \$1.50 for the other work. For a young black teenager in Northwest Texas during the 1930s, that wasn't really too bad.

Leon had attended high school in Sherman, Texas. He had been a good student and an active one. He had played football, he was a member of the debating team and, as he remembered it, was a "scrub" on the basketball team. He liked school, finding interest in English, mathematics, and foreign language. But what really "turned him on" was biology. As it turned out, his biology teacher, John Tonnelle, was also his football coach, and it was he who, recognizing Leon's scientific bent, urged him to seek further education in biology on the college level. "He was a good teacher," Roddy remembered, "and I found myself fascinated by this science. My biology teacher certainly influenced me a lot. When I finished high school, he helped me get a scholarship to partially pay for a college education."

In high school Leon managed to stay at or near the head of a very competitive class. Oddly enough, the fiercest competition took place between him and his girl friend. Each time before an exam, he would go to her house and they would study together. (Somehow they always managed to enroll in the same classes.) Upon leaving he would call out to her, "Martha, I'm going to beat you tomorrow." It didn't always turn out that way, though.

Outside school the active youngster did odd jobs to earn pocket change. Along the way he learned to clean and press clothes—a skill which would come in handy when he went to college.

Fortunately for Leon and his college ambition, Texas College granted him aid in the form of a scholarship. With his earnings from the flour mill and the financial assistance from the college, the young man headed out of

the Texas Panhandle to Southeast Texas and the small, all black, Methodist-supported, Texas College. There he majored in biology. There he was also inspired by the one man biology department—Professor Hilliard. He served as a student assistant in biology in fulfillment of his financial aid responsibility. This gave him the opportunity to spend more time in the laboratory and to learn a lot more about the subject. On weekends he worked in a cleaning and pressing shop in Tyler picking up, cleaning, and delivering clothes to fellow students.

But he never neglected his studies; they came first. Meanwhile back in Amarillo, Floyd Roddy took note of his son's good grades and his determination to see it through. In time the young man's father changed his mind and began sending his son some financial aid. Roddy's record at Texas College was as good as the excellent marks he had set in high school.

Despite intense study and part-time employment, his four years went by rapidly, and he had begun to look forward to being the first of his family ever to graduate from college. But by this time the country was at war with Japan and Nazi Germany, and manpower was sorely needed. So one week before he graduated from the small Texas institution, Leon Roddy (like many young men of his time), was inducted into the United States Army.

War!

Things seemed to have moved fast for young Leon Roddy after that. Texas College awarded him the Bachelor of Science degree *in absentia*. There was basic training at Camp Walters in Mineral Wells, Texas, before being shipped to Camp Beale, California, where he was assigned to an artillery battalion. Not too long afterward, in 1943, he was shipped to England. For two months he and the other men in his unit trained and familiarized themselves with the howitzers. In the meantime, the war was growing in ferocity, and America and her allies were on the offensive. However, more firepower was needed. Men were being called up to the front. Soon Leon Roddy's unit was on the move again. It was sent to France, near the site of the then famous Maginot Line, and into battle, as a part of the 9th Army of General Omar Bradley, against the retreating but still powerful German armies. For a short time Roddy's unit fought with the 3rd Army of General Patton but later transferred back to the 9th Army. Included in his battles was a defensive action during a furious counterattack by the German army in the famous "Battle of the Bulge." But his unit successfully defended its position and fought off the enemy without a foot of ground being taken, nor a single man being lost. Regaining the offensive, the allies battled their way across Germany until the Army of the Third Reich was crushed. One day before his unit was to be shipped to the Pacific to war against Japan, peace was declared, and World War II came to an end.

Back Home

Back in the States, young Roddy began making plans to attend graduate school, as Professor Hilliard, his biology professor at Texas College, had urged him to do. He selected the University of Michigan, attending that midwestern institution with support from the GI Bill.

For the first time in his life Leon Roddy was unhappy at an educational institution. It was not easy for him. He had never been in a class before where he did not receive credit for his classwork performance. It seemed that no matter how well he scored on tests or how high his averages, he nearly always received a C in zoology courses. Only by taking courses in botany, where he consistently received A's was he able to maintain a B average. He felt that his classmates, and even his professor, were standoffish and generally non-communicative. Only one white classmate, a young man from Mississippi could be counted as a friend, and that friendship endures until this day.

For a black student in the Zoology Department of the University of Michigan, at that time at least, Roddy found that things were tough.

Dragonflies, Texas and Ohio

Just the same there were some bright spots at Michigan for ex-GI Roddy. One experience was to leave a positive and lasting impression on him. It came at a time when he was seeking an elective to complete the number of courses required for graduation with a master's degree. At the University Museum he took a seminar from a Professor Rogers. During this time, Dr. Rogers was doing research on a large winged insect called the dragonfly, and Leon Roddy became deeply interested in entomology, the study of insects.

"You've done so well in this course," Dr. Rogers said to his graduate student, "I really think you should do further work. As you know, we don't offer a degree in entomology here, but why don't you go to Ohio State? They have a good program, and I can recommend you to a friend I have over there." To Leon Roddy, the proposal was attractive. Having run into so many problems at Michigan, he was more than ready to leave.

Roddy went to The Ohio State University and enrolled in the summer session. In the meantime, he had been offered an appointment at a small college in Texas called Tillotson College as a biology professor. He was married at this time, and he felt the need to earn a few more dollars to support his growing family. For just over two years he taught biology, but in January he went back to Ohio State to work on the doctorate. There he found a warm, receptive atmosphere with few setbacks due to his racial identity. He remembered:

I was put into an office with other graduate students studying entomology. After a few months, the students went to my major professor and complained that I didn't associate with them. I was segregating myself. But I had learned at Michigan that as a black man, I was to keep to myself. At Ohio State they invited me to things, but I wouldn't attend—

fearful I would run into problems that I just did not want to encounter at that time. But my professor called me in. He said, "Roddy, the other students say you won't have anything to do with them—that when they ask you a question, you answer and just clam up." I could see he was sincere so I tried to explain that I had encountered so many problems while studying for the master's, that I had come to believe that among students of science, all were prejudiced. "Not here," he replied, "forget the past. This is a better place!"

Indeed it was. Except for one inexplicable grade average, it was a better place. Roddy learned that some men of science were as objective in their personal and professional life as they were in the laboratory. He studied hard and in seventeen months earned the Doctor of Philosophy degree. Years later, in 1972, in recognition of his research and publications, he was honored as one of the top alumni from the Department of Entomology of The Ohio State University.

The now Dr. Leon Roddy turned down several offers to teach at northern institutions because he wanted to go back to his native South. "Somehow," he said, "I felt needed back home." Three black institutions, one in Florida, one in Texas, and one in Louisiana bid for his services. After visiting each of them, he finally chose Southern University in Baton Rouge, Louisiana—the school which oddly enough made the lowest salary offer. But he had found the largest and, he believed, most progressive biology department there. Besides, only at Southern were there offerings in entomology. He was also impressed by the Biology Department chairman, Dr. J. Warren Lee. He found in Lee an unusual man, who like himself, was a graduate of Ohio State. "I never met a finer man than that guy. He went out of his way to help me get started. But he also worked the living stew out of me."

Still, that first summer in 1950 was frustrating. It was hot and stifling from the humidity.

And work he did. His teaching hours were long, and the classrooms and laboratories were overcrowded. He had come to Southern just as that institution was experimenting with a plan to graduate its better students in three years, so there were twelve weeks of summer sessions. After nearly two years in Columbus, Ohio, Roddy found the hot, humid summer in Baton Rouge and his exhausting work load almost too much to take. Was this what he had come to Southern for? How long could he last under these energy-draining conditions? When would he ever have time to research? Where was the time? Where was the support?

Insecta

After one long steamy day of lecturing and instructing in the laboratory, Dr. Roddy came to his desk and slowly sank down in the old swivel chair before it. He was tired. He swung his chair around and gazed out the window looking westward over the moss-draped old oak trees that bordered the campus and separated it from the Mississippi River with its heavy shipping traffic. Sometimes, when the atmospheric conditions were

right, the sun would set in the west, ablaze with vivid colors, oranges, reds, and yellows. And at the bend of the river, not far from the university president's home, one could see a fascinating sunset, reflected in the muddy waters of "Ole Man River." It added another touch of beauty to an attractive campus.

A colleague was approaching him. He had these insects, he said. They were all collected in Louisiana but had never been classified. Could Roddy—would he classify them? He would. The weariness forgotten, the young scientist eagerly went to work. There were one thousand insects—all different.

For sheer numbers and adaptability, insects are unmatched by any animals in the world. They are found in the air and on land. They are found in the dry desert and in the rain forests, in the tropics and the northern glacial lands, in cold mountain streams and hot springs. Insects are found almost everywhere.

Some insects, like the dragonfly and honey bee are beneficial to man. Others like the mosquito, housefly, louse, flea, bedbug, and many stinging insects are at least annoying and at worst deadly. They help or harm crops, health, and the beauty of the land.

Insects have six legs and three parts to their body, called head, thorax, and abdomen. Scientists divide all animals in groups called phyla. Insects are found in the phylum Arthropoda. All arthropods (like the crayfish, lobster, crabs, shrimp, etc.) have segmented bodies and jointed limbs. If they have a skeleton, it is on the outside of their bodies (exoskeleton). To further distinguish animals from one another, scientists divide them into class, order, genus, and species. Insects are placed in the class Insecta. Presently more than 850,000 species of insects have been identified, and entomologists (the scientists who study insects) are still counting.

Carefully and meticulously Roddy first labeled and studied each of the little animals in detail. Accurate and well-organized notes were kept. Close attention was given to each structure: the mouth parts, eyes, wings, antennae, limbs, abdomen. When necessary he knew how to dissect the animals to study their internal structures. Far into the night he worked, naming each and every little arthropod. Occasionally he would pause to wipe the sweat from his brow and the back of his neck, just as he had done many years ago in the Texas flour bin. He marveled at the precise anatomy of his specimen, seeing how each part was especially suited to help the insect adapt to its environment and reproduce its kind. His list of identifications grew. He catalogued each of the insects, using the special universal language of the scientist . . . *Stomoxys calcitrans*, *Pyrausta nubilalis*, *Blissus leucopterus*, *Pieris rapae*. In the end, it was done. . . . One thousand insects collected in Louisiana had been identified. Many announced for the first time in that state!

The Spider Man

Not long afterward, Roddy's attention was directed to a collection of unidentified spiders in the department, and he was asked to classify them. Spiders, like insects, crabs, and lobsters, are arthropods. Unlike insects however, these animals have eight legs. Another difference is that while insects have three parts to the body, a head, thorax, and abdomen, spiders have only two parts, a cephalothorax and an abdomen. Spiders are placed in a special group called the arachnids or class Arachnida and order, Araneida.

Few animals are as misunderstood as these little creatures. Myths and legends abound about them. Science fiction stories often portray the spider as a sinister gigantic monster, almost indestructible and bent on destroying mankind and all civilization. Thus, science fiction and the widespread ignorance about spiders combine to produce unreasonable fear about them.

As an entomologist, Dr. Roddy found it easy to identify the spiders found at Southern. But he did not stop there. Soon he launched into a full-scale scientific investigation of the spiders found in the swamps and bayous as well as the flatlands and hills of Louisiana. In due time, he became the foremost authority on spiders in the state and a leading authority in the nation. Soon scientists from foreign countries began writing Dr. Roddy, asking for copies of the articles he published in professional journals. In the exclusive international list of authorities on the spider, he is the only black man. New species, never before identified were included in his publications. Thousands of spiders have been identified by him for some of the world's leading authorities on arachnids. But to his friends and students in and around Southern and Baton Rouge, he was simply known as "The Spider Man."

"We really don't appreciate the spider," he would often say. "This animal is insectivorous so spiders consume an enormous quantity of insects that would otherwise plague man, his crops, and his livestock. They do far more good than harm. Their web is useful in manufacturing sights for microscopes and for other optical instruments. As for poisonous spiders, there is only one kind native to this state—the black widow." He let the people of Louisiana know that neither the brown recluse, nor the feared tarantula poisonous spider were native inhabitants of the Bayou State. "Even the black widow spider," he said, "shies away from man." "Despite the publicity," he said, "there is only one case where we know that the bite of a spider was fatal."

Leon Roddy has identified more than six thousand spiders in his life. Once when the United States Army wanted to know if its troops stationed in Bay St. Louis, Mississippi, might be exposed to poisonous spiders, they sent for Dr. Roddy. After three months of intensive investigation, he was able to report to the base commander that the only poisonous spider to be

found in the area was the black widow, and she was found only rarely.

The Southern University biologist became an expert on the spider as a result of this interest and curiosity. For many years he has engaged in spider research, in the field and the laboratory with little or no research support funds from the institution, the government, industry, or philanthropic groups. Unfortunately it is difficult to attract research funds when the goal of the scientist is to engage in pure research, that is, his sole purpose is to broaden man's knowledge about his world. Yet, as we have seen, this knowledge paid off in an unexpected way in providing important information for the United States Army.

A few years later, The Spider Man was again pressed into service. In the central part of the state, more than a hundred miles away, a woman had been bitten by a spider while she was in bed. She had crushed the animal and saved it. Having read a newspaper article about "The Spider Man," she sent an urgent call for him to identify the animal. She thought she had been bitten by the venomous brown recluse. Would he identify the spider? He would. Of course he would.

Arriving in the Central Louisiana town, Roddy quickly identified the spider. It was the brown recluse! Now the doctor could take action. Knowing what kind of spider had bitten his patient, he was then able to prescribe the correct antitoxin. This done, the patient recovered in due time.

The discovery of the brown recluse raised another and very serious question. Had the brown recluse moved from the Midwest into this Central Louisiana town? Would the citizens need to be alerted and educated about the habits of this shy but venomous creature? It was at this point that Dr. Roddy had to put his expert knowledge as a biologist to work. The scientific snooper investigated place after place where a brown recluse might reside and reproduce. After an extensive search he was able to announce that the brown recluse was not yet an inhabitant of that area. The brown recluse that had bitten the local citizen had apparently been carried into the state as a lone animal.

Leon Roddy is still searching the highlands and lowlands of Louisiana, learning more and more about the misunderstood spider. He has been bitten by them many times. Sometimes, his right to study a given spider has been challenged by a water moccasin in his path. At other times he has vacated his territory in haste because a bobcat objected to his presence. But for his work with spiders, national and international recognition awards have come his way. Unquestionably, he is "The Spider Man."

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The material for this chapter was drawn largely from personal communications and recorded interviews.

ELIJAH McCOY



Inventor 1843-1929

Exyie C. Ryder

ELIJAH McCoy was born in Colchester, Ontario, Canada in 1843. He was the son of runaway slaves who had used the "underground railroad" as an escape route from the South and from the hardships of slavery. The underground railroad was not really a railroad, for it had no trains or tracks. Instead it was a carefully planned network of secret roads, paths, and hiding places, set up by slave sympathizers and former slaves who risked their own lives offering assistance and refuge to slaves who desired to escape from their owners. McCoy's parents had belonged to a family in Kentucky before fleeing across the border into Canada.

When they settled at last in Canada, the McCoy's were very, very poor and barely capable of sustaining themselves during the cold wintry months. Yet, in another sense they realized they were rich in their newly found freedom, for it allowed them to think, dream, and even work toward a better life. Furthermore, since one of their most cherished desires was

an education for their children, McCoy's father labored and sacrificed endlessly in order to send his son abroad to study. When Elijah was 15 years old, his parents sent him off to Edinburgh, Scotland, to study and train to become a mechanical engineer.

Upon completing his studies in Scotland, McCoy returned to the United States as an educated, well-trained, ambitious mechanical engineer. So eager was he to begin his career, that he immediately sought employment in and around the Ypsilanti, Michigan, area where he had decided to live. But for him it was not easy. Although openings in mechanical engineering were plentiful, and McCoy's credentials were extraordinary, he was repeatedly denied a position in engineering because of his race. Finally the necessity to earn a living compelled him to accept a job as a fireman for the Michigan Central Railroad. His duties included shoveling coal into the engine and oiling all of the moving parts of the train, including the engine and the wheels.

Such a menial job for a trained mechanical engineer was, by any measure, a waste of talent. McCoy felt underemployed—a term used to describe a situation in which a person is hired onto a job that requires much less than he is capable of producing. McCoy's job as a fireman-oilman was neither challenging nor interesting. His duties were more or less routine and offered little or no opportunity to think and make decisions. Time passed slowly until one day he asked himself, "Why can't this train lubricate itself?" So oddly enough, it was on this job as a combination fireman-oilman for the railroad company that the curious young engineer became interested in the problems of self-lubrication. From that day on, McCoy began to think seriously of ways in which the train and all other machines could lubricate themselves.

Self-Lubricating Machines

His ideas for the design of a self-lubricating machine slowly began to emerge. Before he realized it, he was working on his railroad job during the day and spending all of his spare time testing ideas with his few tools in his tiny workshop at home. McCoy enjoyed the challenge that his problem presented, and he was thrilled to be engrossed in its solution.

In 1870, he opened the Elijah McCoy Manufacturing Company in Detroit. It was in his own shop that he invented the automatic lubricator, for which he was granted a patent from the United States Patent Office on July 2, 1872. His first invention, named a "lubricator cup," was designed to allow small amounts of oil to drip continuously onto the moving parts of a machine while the machine was in operation.

The lubrication cup was a significant development in the industrial world because prior to its invention, all motorized machinery had to be brought to a complete stop periodically so that lubricants could be applied to all of the moving parts. It had long been recognized that stopping

and starting large engines, in addition to the time required to oil them by hand, constituted a tremendous loss of time and money. Consequently, profits in industry were consistently low; the average loss estimated to be almost 25 per cent of the possible profit. In spite of such heavy losses, the metal parts of a machine, which moved against each other, had to be lubricated regularly to reduce friction and minimize the build-up of heat which could burn out or severely damage the machine parts. Since no one knew exactly when lubrication was needed for a machine, frequent stops were scheduled by men who approximated the length of time before another lubrication was necessary.

"The Real McCoy"

Because the lubrication cup was adaptable to many different kinds of machinery, it was acquired almost immediately by industries all over the country and abroad. Anyone who owned a self-lubricating machine boasted of having the "Real McCoy," an expression that is still used today to indicate impeccable performance and quality.

McCoy soon replaced the first version of the automatic lubricator with a more sophisticated model which, through the use of a stopcock, regulated the time intervals between lubrications. This model was an improvement over the original lubricating cup which dripped oil continuously onto the machine. For the next twenty-five years, McCoy made improvements in his original inventions and received more than fifty patents for various modifications of the automatic lubricator.

In his machine shop, Elijah McCoy continued to study and test a variety of lubricants and their effects on different kinds of machinery. Knowing that lubricants include thin oils, heavy greases, and also slippery solids such as a form of carbon known as graphite, McCoy then turned his attention toward specialized lubricating devices for special kinds of machinery, such as air brakes and steam engines.

While he worked earnestly and energetically, concentrating on the development of self-lubricating devices, he inadvertently designed an ironing table and a lawn sprinkler, for which he received patents in 1874 and 1899, respectively.

The invention of the automatic lubricator brought McCoy instant fame in the field of mechanical engineering, in addition to modernizing the industrial world. To industry, his inventions were very important contributions because they reduced time and labor costs significantly and increased business profits substantially. As expected, McCoy was suddenly in demand as a consultant and lecturer. He received invitations from large industries here and abroad to serve as a consultant in mechanical engineering. And quite often, when companies purchased one of his lubricating devices, he was asked to assist in its installation and instruct

plant personnel on its usage. Such recognition should leave little doubt in anyone's mind that Elijah McCoy's genius in his field was acknowledged and highly respected.

Yet, as the big industrialists requested the services and expertise of Elijah McCoy, oftentimes they were unaware of his race. They were surprised to learn that the ingenious invention at hand was conceived in the mind of a black man. There were times when they cancelled scheduled appearances and even refused to use the lubricator they sorely needed. However, in time, McCoy's invention and his name gained popularity, but the man himself was never completely accepted and what recognition he received was generally limited to the industrial-mechanical world.

McCoy kept a very busy schedule, lecturing, conducting seminars and workshops, and spending whatever extra time there was in his machine shops. While he distinguished himself among colleagues in the field of engineering, he managed to live quite an ordinary private life, preferring the company of his wife, family, and a few close friends. He took special interest in the black youth of Detroit; volunteering a few hours each week in a local youth center. He hoped to inspire the young teenagers to set high goals and work toward achieving them. Aware of his own successful career, McCoy wished that he could somehow, in a very subtle way, be a model or example for the boys whose lives he tried to reach. He consistently urged the city youngsters to study hard in school, while he tried to impress upon them the need for an education. He encouraged them to spend their spare time productively.

As McCoy advanced in age, he maintained a very interesting life, keeping abreast of developments in mechanical engineering and continuing his work with the youth of Detroit. He remained mentally alert and physically active until his death at the age of eighty-five.

An everyday reminder of Elijah McCoy's greatness is the popular expression "The Real McCoy." Yet, ironically, few persons who use and understand this phrase have any idea how it was derived or to whom it refers. Other and perhaps more important reminders of McCoy include locomotives, automobiles, buses, moon rockets, ships, and all other modern machinery that contain some version of the original McCoy lubrication cup.

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DANIEL HALE WILLIAMS



Pioneer Heart Surgeon 1856-1931

Exyie C. Ryder

IN Hollidaysburg, Pennsylvania on January 18, 1856, Daniel Hale Williams was born to Daniel and Sarah Williams. He was the fifth of their seven children. Unlike many other blacks during that time, his parents were free. His father was of German and Negro ancestry, and his mother was part Negro and part Indian.

The Williams children were fortunate, for they never experienced the ills of slavery. Their father owned a barber shop; a successful business which enabled him to afford a comfortable home for his family. He sent his children to school regularly, while constantly reminding them of the importance of an education, especially to black people.

When Dan was just eleven years old, his father contracted tuberculosis and died, leaving behind his wife and their seven children. Almost immediately, Sarah Williams realized that she was unable to support herself and the children. She was finally compelled to accept the assistance

of relatives and friends who offered to help her, and the family was separated. Dan was sent to a friend in Baltimore who owned a shoemaking shop, to learn how to make shoes. But after the first day's work in the shop, Dan was disgusted. It was a miserable experience for him. And besides, the thought of making shoes for the rest of his life was even more disheartening. He was restless, unhappy, and disappointed at not being able to attend school any longer. Many times during the day, he thought of his father and recalled how often his father spoke of acquiring an education.

Thinking that his opportunities for schooling would be greater in a state such as Wisconsin than in a border state such as Maryland, Dan moved to Edgerton, Wisconsin, to live with an older sister. Here he was much happier, for he worked as a barber and had free time for reading. In the meantime, he inquired about schools in the area and learned of a private academy in nearby Janesville, Wisconsin. Dan moved there and was hired by a local barber, Harry Anderson, who in addition to giving him work, agreed to let him live in his home. The Andersons were fond of Dan and treated him as they did their own five children. In fact, they provided a real home life for him. Besides cutting hair, Dan was able to make extra money playing guitar in Mr. Anderson's string band. He attended the local academy and even found time for extra reading. In 1877, he received his high school diploma from the academy.

Apprentice Doctor

The town physician, Dr. Henry Palmer, was a regular customer at the Anderson barber shop. Dan admired Dr. Palmer, and enjoyed chatting with him whenever he visited the shop. After many conversations with him about his work, Dan was convinced that he wanted to become a doctor—an idea that he had considered for a long time. He knew that in order to become a doctor, in those days, one had to work as a doctor's helper until he learned enough about medicine to be on his own. So finally one day, Dan approached Dr. Palmer and asked permission to work as his assistant. Fortunately, Dan's ambition and interest in medicine impressed Dr. Palmer, who willingly agreed to permit Dan to train under him. Initially, Dan was introduced to routine chores, and gradually he was allowed to treat minor cuts, fractures, aches, and pains, under Dr. Palmer's supervision. Meanwhile, he increased his knowledge of medicine by reading the medical journals and books that were in the office. Learning the practice of medicine through an apprenticeship was not sufficient to satisfy Dan's ambition to become a good doctor, which to him meant becoming an educated doctor. So Dan was essentially preparing himself for medical school.

At the end of almost two years with Dr. Palmer, Dan applied and was admitted to the Chicago Medical College, an outstanding medical

school. Dr. Palmer recommended him very highly, for he was confident that Dan possessed the ability, skill, devotion, and stamina necessary to be a good doctor.

Dan's greatest worry continued to be the lack of enough money, and he knew that concentrating on his studies would be increasingly difficult as his financial problems mounted. Luckily, he was able to obtain several loans from Mr. Anderson, with whom he had lived. He wrote to an older brother, a lawyer in Philadelphia, and also received some assistance. His brother, incidentally, had earlier expressed hope that Dan would consider becoming a lawyer, but Dan never acquired the interest in law that he did for medicine.

The first year in medical school was exciting and challenging. Dan had very little extra time, since his studies demanded almost every minute that he could spare. The second year seemed better and he found some time to relax, probably because he was familiar with the situation and could reasonably predict what was expected of him. After eighteen months, he completed his medical training and received his diploma in March 1883.

Dr. Dan, Surgeon

Immediately following graduation, Dr. Daniel Hale Williams opened an office on Chicago's South Side, at Thirty-first and Michigan Avenue, in a neighborhood that was becoming heavily populated with southern black immigrants. During his first years of practice, Dr. Dan, as he was called, was very busy treating mostly common illnesses. Occasionally, his patients asked him to perform surgical operations, which he did either in his office or in the patient's home. Performing surgery under such circumstances was difficult for the doctor. Ideally, a patient requiring surgery should be admitted to a hospital, where care is taken to isolate him from germs which might bring about infection, the major cause of complications following surgery. But because black people were customarily the last to be treated, frequently neglected, and often released prematurely, many blacks preferred to risk an operation on their kitchen or dining room table by a black physician who would care for them attentively, than go to an overcrowded, all-black, charity ward of a hospital and be treated disdainfully. Consequently, Dr. Dan and many other black doctors were often asked to perform surgery.

The first six years of Dr. Dan's practice was medically successful. His patients usually recovered as a result of his treatment and care, and he earned a reputation as a successful surgeon, although he had never performed an operation inside a hospital. His patients were both black and white, and of various ethnic backgrounds.

For a long time, Dr. Dan had dreamed of opening a hospital, where

black people could go and receive the kind of medical care they needed, promptly, courteously, and efficiently. He envisioned a hospital where people of all races would be welcome, where black doctors and white doctors could practice together, and where black young women could train to become nurses. He expressed his ideas on the need for such a facility to many of his friends in Chicago. Although there was unanimous agreement on the necessity of a hospital for blacks, there were some reservations expressed about opening the hospital to all people, regardless of color. But Dr. Dan felt strongly that a hospital should serve all the people, and he henceforth proceeded to see that the proposed facility was established in that way.

Provident Hospital Opens

Realizing that equipping a hospital was an expensive undertaking that could only be accomplished through the combined efforts of many people, Dr. Dan began to devote much of his time toward gaining support for his idea. Fortunately, the ministers pledged their support, and in turn, used their positions and status to persuade their congregations. Convincing the community was not too difficult, for most blacks already knew how desperately they needed the services of a hospital on which they could depend. As people rallied behind the idea, they began to donate bed linens, pillows, mattresses, old beds, cots, kitchen utensils, mops, buckets, and many other items that they thought could be utilized in a hospital. Many fund-raising activities were held, and supporters who were financially able, contributed cash. The money was used to purchase instruments, medical supplies, and drugs.

In May of 1891, Dr. Dan's dream came true; the twelve-bed Provident Hospital opened at Twenty-ninth and Dearborn Streets in Chicago. Its policy was to admit people of all races, and on the staff were highly skilled black and white physicians. With the exception of one appointee, Dr. George Hall, the entire staff was personally recommended by Dr. Dan, after he carefully reviewed each man's qualifications. Dr. Hall neither forgot nor forgave Dr. Dan for rejecting his application, and after that, took every opportunity to subvert his programs.

Working very hard, Dr. Dan went sometimes as long as twenty-four hours without sleep. But he was determined to see that the hospital operated efficiently and was kept clean. Every night, he scrubbed and disinfected the entire hospital before he ended his day's work.

A nurses training program was initiated; and in the first class, seven young women completed the challenging eighteen-month course. Although trained black nurses were badly needed, Dr. Dan's standards of admission were so high that only seven of the approximately two hundred original applicants were accepted. These, he surmised, would be able to master the program and eventually become competent nurses.

After one full year of operation, the hospital had a remarkably successful record. Since the facility was small, hospitalization was extended only to patients who were very seriously ill and to those in need of surgery. Nevertheless, the percentage of successful recoveries was far above that of the average hospital, and the death rate was far less. News of the success of Provident Hospital spread around the state and around the country. Community support continued, and Dr. Dan never ceased soliciting contributions to ensure continuous operation and maintenance of Provident. The generous response of the community signified its pride in Provident Hospital.

Despite the problems of running the hospital, Dr. Dan always found time to read a medical journal or refresh his knowledge of anatomy or physiology before going to bed. He knew that he must keep himself informed of new techniques, drugs, and other developments in the field of medicine. If he were scheduled to perform an operation on the following day, he would review the anatomy of the particular body region and apprise himself of the patient's medical history.

Dr. Dan, by this time, was well known as a skillful surgeon. Although he moved very cautiously, he did not hesitate to take professional risks when he was confident that he was sufficiently prepared. His colleagues regarded his techniques and skill as nothing less than amazing. As a result, whenever he performed an operation, other physicians would scrub down and come into the operating room to observe the procedure. Scrub down simply means freeing oneself of pathogenic bacteria that cause infections.

"Sewed Up His Heart"

On the night of July 9, 1883, a young man by the name of James Cornish was stabbed in the chest with a knife during a fight in a bar near Provident Hospital. When Cornish was brought in, Dr. Dan examined him and found that there was very little bleeding. But within a short while, the patient went into shock and his pulse was almost nonexistent. Obviously, he was losing blood—bleeding internally. Dr. Dan had very little time to think, for the patient was already very close to death. The two choices before him were either to allow the man to die or try to save him. Very quickly, he contacted six of his colleagues and informed them of his decision to open the man's chest cavity. Meanwhile, he requested some aides and nurses to assist in the preparation of the operating room. The thought came to him that since no such surgery of the chest had been tried before, both his career and reputation would be at stake if the patient died. But he also knew that the patient certainly would not survive long if something were not done at once. Reasoning that his humanitarian duty was to try to save Cornish, Dr. Dan adhered to his decision to operate and performed the successful operation that made him famous.

The six physicians came immediately to watch the operation. Dr. Dan carefully extended the one-inch knife cut to about six inches so that he could open up the chest to examine the heart. He found that the knife had penetrated a little more than an inch, and that a severed major blood vessel was causing the rapid loss of blood. As he proceeded meticulously, but promptly, into the chest area, he tied the ends of smaller blood vessels to prevent any further loss of blood. When the heart was within view, he observed that the scar on the heart tissue, itself, was very small and would not require any sutures. The wound was primarily confined to the pericardium, which is the membrane that envelops the heart. Working swiftly and cautiously, Dr. Dan cleansed the wound with a salt solution, rejoined the artery, sutured the pericardium, and closed up the incision.

The next day, headlines in the Chicago paper read "Sewed Up His Heart." People everywhere heard of the operation and wondered how Dr. Dan managed such surgery. Even today, it seems miraculous, for in the 1890s, X-rays were not available to doctors, there were no trained anesthesiologists to administer the precise amount and kind of anesthetic, no electrocardiograms to monitor the patient's heartbeat during the surgery, and no machines to aid in the pumping of blood. Moreover, the probability of infection was very high, and antibiotics were not available.

Dr. Dan's success can be attributed to the fact that he was thoroughly grounded in anatomy, physiology, and up-to-date surgical practices. He had anticipated the most likely problems and had taken steps to prevent their occurrence. First, and probably most important, he made every effort to ensure a sterile environment. Second, he knew that a person in shock experiences little or no pain, and would therefore be unaware of the surgery; however, he administered a local anesthetic as a precautionary measure. And finally, he assigned two men to hold the patient firmly against the table to prevent any movement during the operation.

At the time the operation was completed, no one dared speculate on how long Cornish would survive the stab wound or the surgery. But on the fifty-first day following the operation, he was released, strong and healthy again. He soon returned to his job as a laborer in a Chicago stockyard. Cornish lived more than fifty years after that history-making ordeal. In fact, he lived twelve years longer than Dr. Dan, his famous surgeon.

Move to Washington

Dr. Dan's fame and well-earned reputation resulted in his being offered the position of chief surgeon at Freedmen's Hospital in Washington, D. C. Freedmen's was a large, two hundred-bed, government-owned hospital, established to provide health care for ex-slaves. Dr. Dan viewed the offer with mixed emotions, for he was dedicated to Provident

Hospital and to the many friends who had helped bring it into existence. On the other hand, he felt the need to be in a position where his knowledge could benefit the greatest number of people. He looked upon the offer at Freedmen's as one that would be more challenging for him medically, since it offered teaching and research opportunities through its affiliation with the Howard University School of Medicine. Recognizing these advantages, he decided to accept the position. He left Provident and moved to Washington following his official appointment in February 1894.

The initial survey of Freedmen's Hospital indicated to Dr. Williams the inefficient use of both the staff and the facilities. He observed that medical practices were antiquated and that in many instances, patients received the kind of care that was a result of either carelessness or ignorance on the part of the staff. As expected, the death rate was enormously high. Promptly, Dr. Williams pursued a course of action that is never popular. He moved to reorganize the entire hospital in an effort to modernize and improve its operation. New departments were created to control specialized areas of medicine, such as bacteriology and pathology. He established a nurses training program and initiated a program of internship for black medical students. Meanwhile, he carefully scrutinized the qualifications of his staff and found that many of the physicians would have to be replaced. To the chagrin of many, Dr. Williams searched around and succeeded in recruiting highly competent and well-trained black and white doctors, many of whom were specialists. Such action was necessary because a departmentalized hospital needed specialists in the different areas of medicine, rather than a large number of general practitioners.

Dr. Williams' first year at Freedmen's was an overwhelming success. The mortality rate decreased sharply from a previous high of greater than 10 percent, while recoveries became more numerous and much quicker. Surgical operations of the abdomen and other parts of the body were performed with increasing frequency and with astonishing success. Dr. William did most of the operations, himself; almost always in a lecture-demonstration type setting, in order that physicians and medical students from nearby colleges could observe the procedures. In addition to the very full schedule maintained at the hospital, he taught classes in surgery to medical students at Howard University, and held clinics periodically for faculty and students at other medical schools.

Although Freedmen's experienced tremendous success in its ability to provide quality health care, the Williams' administration could not escape the whims of politics. Increasing opposition to Dr. Williams arose, and he soon found himself spending almost as much time fighting political battles as he was devoting to medicine and his duties of overseeing the operation of the hospital. Finally, in February 1898, he re-

signed from Freedmen's and decided to return to Chicago. Before leaving, he married Alice Johnson, a teacher whom he had met while in Washington.

Return to Chicago

Dr. Dan returned to Provident and at the same time affiliated with two other hospitals in the Chicago area; namely, Mercy Hospital and St. Luke's Hospital. He became active in organizing the National Medical Association, a professional organization which black physicians could join, since they were not allowed membership in the all-white American Medical Association. He also continued to hold clinics at medical colleges, particularly Meharry in Nashville, Tennessee, and Howard in Washington, D. C.

It was soon apparent that his return to Provident was not welcome, although many of his friends and former patients expressed delight in having him back. In particular, his former colleague, Dr. George Hall, made working conditions quite uncomfortable for him. While Dr. Dan was in Washington, Hall, through political maneuvering, succeeded in attaining a position on the Provident Hospital Board. Consequently, when Dr. Dan returned, Hall was in a position to wield power against him.

In 1912, Williams was offered the post of associate attending surgeon at Chicago's prestigious St. Luke's Hospital. Some of his black colleagues at Provident felt that he should decline the offer since other black physicians were not allowed to practice there. Some even charged that Williams was being overly responsive to wealthy whites and questioned his loyalty to sick people of his own race. Few looked upon it as an honor. But Dr. Williams accepted the appointment, and was thereupon ordered by the Provident Hospital Board to move all of his patients to Provident, immediately. Dr. Williams refused to comply with such nonsense and chose instead to resign from Provident and work full time at St. Luke's.

Daniel Williams' accomplishments and reputation were earned through a unique combination of persistence, hard work, and intelligence. His career was marked by a series of unprecedented honors for a black man. Soon after he began his practice, he was made an instructor in anatomy at the Chicago Medical College, and was later appointed staff surgeon at the Chicago South Side Dispensary. About the same time, he became the first black to serve as surgeon for the City Railway Company, and in 1889, the first black appointed to the Illinois State Board of Health. All of these achievements, of course, were prior to his famous heart surgery in 1893.

A special celebration was held in 1908, marking his twenty-five years of success in medicine. Physicians from all over the country came to

Chicago to attend the banquet in his honor. The event was a very special tribute to him at the time, but it did not signal his retirement from medicine. Since it was his silver anniversary, a silver bowl, bearing names of the Provident Hospital staff was presented to him.

Williams' contributions to the advancement of the field of surgery were in lectures, demonstrations, published articles, and papers presented at various professional meetings. In recognition for his contributions, he was invited to become a charter member of the American College of Surgeons when it was established in 1913. He also held the distinguished honor of being a member of the Chicago Surgical Society.

In 1920, Dr. Williams retired from St. Luke's Hospital and also from his thirty-seven years of medical practice. He had built a summer home in Idlewild, Michigan, where he and his wife had looked forward to relaxing after his retirement. Unfortunately the time together in Idlewild that they had so anxiously awaited ended in just one year, when Mrs. Williams died. Very sad and lonely without the companionship of his wife, Dr. Dan managed to find solace in attending his flower garden and doctoring his sick neighbors when called upon. Five years later, he was the victim of a severe stroke, which left him paralyzed and in gradually deteriorating health. On August 4, 1931, at the age of seventy-five, Dr. Daniel Hale Williams, the famous pioneer heart surgeon, died at his home in Idlewild.

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